



NORTHERN REGION OF NIGERIA

Annual Report
on the
Department of Agriculture
of the
Northern Region of Nigeria
1952-53

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FOREWORD

In a Region such as ours where agriculture forms the solid basis of the economy it may be truly said that development of the social services is virtually dependent on development in agriculture. I wish, therefore, to congratulate the Director of Agriculture and his staff on the excellent progress that has been achieved both in the extension services and in the prosecution of research. The two services are equally important and inter-dependent. Improved planting material and breeding stock, improved techniques and disease and pest control are little use if they are not brought to the farmer by an efficient extension service, but without a vigorous programme of research to feed it the extension service would die. This progress will continue and its tempo will increase as more trained staff become available, but, alone, it will not be sufficient to achieve the aims we desire. The following words which were written in 1952 by my predecessor are equally true to-day :—

“If the goal of the Agricultural Department is to be reached, many old prejudices and retarding influences—particularly in the use of land—will have to be modified or abolished. In a speech in the House recently, on Industralisation in the Northern Region, I mentioned the approach of an agricultural “revolution” in which the individual, as opposed to the community, will seek permanent possession of between thirty to fifty acres of contiguous farmland in order that he may have the basic requirement of a modern farm and make himself self-sufficient in land. The Department recognises the signs of this impending revolution and is striving to keep abreast of it by applying itself *now* to research and experiments which will provide true guidance in the future”.

The Agricultural Department is playing its part. It remains for Native Authorities and the other leaders of public opinion in the Region to play theirs.

P. S. ACHIMUGU,
Minister of Natural Resources
Northern Region

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ANNUAL REPORT ON THE DEPARTMENT OF AGRICULTURE OF THE NORTHERN REGION OF NIGERIA, 1952-53

1. *Staff and General.*—The number of fully trained Agricultural Officers still remains deplorably small for such a large and populous region. An increase of one only can be recorded since the previous year. At the same time recruitment to the Irrigation and Engineering sections has brought these up to strength. Valuable assistance to the Agricultural staff has been given by Superintendents and Development officers, while extension work has benefitted by the appointment of 26 Production Officers directly recruited by the Northern Regional Production Development Board to serve with the Department. These have taken the place of the former Cotton and Fibre officers, whose scope was limited to particular crops.

Assistant Technical Staff trained under the department numbered 187 at the end of the year. Wastage in these grades amounted to 17 and is large enough to require consideration in future recruitment.

A summary of the establishment apart from staff posts is given here :—

Post						Establishment	Strength	Vacancies
Senior Agricultural Officers	..	..	..	..	..	10	6	4
Agricultural Officers	..	..	..	..	..	24	12	12
Agricultural Superintendents	..	..	..	..	..	13	11	2
Agricultural Development Officers	..	..	..	..	..	18	13	5
Irrigation Engineers	..	..	..	..	..	7	7	—
Agricultural Engineers	..	..	..	..	..	3	2	1
Mechanic Demonstrators	..	..	..	..	..	12	8	4
Specialists	..	..	..	..	..	5	3	2

2. *Organisation.*—The inception of the Production Division financed by the Northern Regional Production Development Board and under departmental direction, involved the creation of Assistant Director's and Principal Agricultural Officer's posts to take charge of their work. These officers worked from Headquarters at Kaduna.

Samaru, 60 miles away by road from Kaduna, is the main research station and headquarters for specialists, the Agricultural Training School and the Engineering section.

The Irrigation Section maintains its headquarters at Sokoto, while the newly appointed engineers are gaining sufficient experience to work on their own. Some reorganisation will be needed when this section becomes established.

3. *The Season.*—Over such a wide range of country it is difficult to give a complete picture. Conditions were generally more difficult than in the previous year. Drought at planting time and the incidence of the Ramadan fast reduced yields of cotton and groundnuts. Corn yielded satisfactorily. In spite of these adverse factors, the Groundnut crop made a new record, but Cotton was considerably down on 1951.

Typical rainfall records are given below,

NORTHERN BELT

Months	KANO		SAMARU ZARIA		GUSAU	BORNU	BORNU (MAIDUGURI)	
	1952	Average 26 years	1952	Average 29 years	1952	Average 19 years	1952	Average 36 years
January ..	—	—	—	—	—	—	—	0.01
February ..	—	0.01	—	0.04	—	0.05	—	—
March ..	—	0.08	0.14	0.31	—	0.77	—	0.01
April ..	—	0.41	0.13	1.22	—	0.80	—	0.25
May ..	7.02	2.56	5.09	4.94	4.07	3.35	2.04	1.59
June ..	2.89	4.06	6.27	6.42	5.88	4.69	0.93	2.65
July ..	11.98	8.25	13.02	8.83	6.06	7.33	5.32	6.81
August ..	10.91	11.88	8.04	11.45	11.73	12.51	10.26	8.80
September ..	6.91	5.53	9.00	8.64	12.34	7.05	5.31	4.23
October ..	1.27	0.58	1.82	1.44	2.43	1.08	0.77	0.75
November ..	—	—	—	0.03	—	—	—	0.01
December ..	—	—	—	0.01	—	—	—	—
	40.98	33.36	43.51	43.33	42.51	37.61	24.63	25.11

SOUTHERN BELT

Months	PLATEAU (RIYOM)		NIGER (BIDA)		BENUE (YANDEV)		ILORIN	
	1952	Average 11 years	1952	Average 17 years	1952	Average 26 years	1952	Average 48 years
January ..	0.24	0.03	—	—	—	0.3	1.83	0.28
February ..	—	0.32	—	0.24	0.15	0.7	0.10	0.65
March ..	0.97	0.96	—	1.26	0.83	1.32	2.54	2.15
April ..	4.29	3.68	3.04	2.44	4.98	4.01	3.15	4.09
May ..	7.68	7.68	7.17	6.09	5.90	7.11	5.16	6.62
June ..	7.83	8.60	5.11	6.96	8.70	7.8	8.09	7.59
July ..	5.50	9.86	7.37	7.83	5.47	5.22	8.64	5.52
August ..	8.14	13.31	6.21	8.54	8.42	6.73	1.79	4.91
September ..	7.27	9.88	10.12	9.55	11.56	10.9	12.25	9.58
October ..	2.76	2.91	1.70	3.93	8.20	9.11	5.55	6.82
November ..	—	0.15	—	0.36	—	0.57	0.13	1.18
December ..	—	0.12	—	—	—	0.17	3.84	0.31
	44.68	57.50	39.72	47.20	54.21	51.51	53.07	49.70

4. *Shika Stock Farm*.—Health was well maintained among the young animals. The herd increased from 656 to 734 while there were 65 issues to other stations for breeding. An improvement was noted in the mortality of calves from scour.

Herd lactation averages were not as good as in the previous year owing to a change to machine milking, which proved unsuitable for these breeds. They still however indicate a general advance due to selection.

Year	White Fulani Herd (lbs)	Sokoto Herd (lbs)
1931	1,473	No records
1936	2,200	2,346
1941	2,426	2,289
1946	2,336	2,727
1951	2,788	2,722
1952	2,577	2,732

In the White Fulani herd 25 cows gave lactations of over 320 gallons. Of these 6 were first calvers compared to 1 in 19 similar lactations last year. The Sokoto herd also included 5 first calvers in 13 lactations over 320 gallons.

A summary of herd records for the year, in the form agreed to for comparative use in the Colonies at a Conference in Edinburgh in 1948, is given herewith.

SUMMARY OF HERD RECORDS FOR YEAR

BREEDS : White Fulani and Sokoto
STATION : Shika, Zaria, (Nigeria)

AVERAGE RAINFALL : 42.36 inches in 81 days
MEAN ANNUAL TEMPERATURE : Approximately 77.9

1	2	3	4	5	6	7	8	9	10	11	Remarks
Total number of Adult Females in Herd at 31-3-53	Average out-put milk per cow per annum	Number of full time Lactations	Lactation Record in lbs.			Average Lactation Period in Days	Average Butter-fat per cent	Average Butter-fat yield	Average Daily Yield		
			Average yield in 305 days	Range in Yield and Days	Average Lactation Period in Days				During Lactation	Between Calves	
White Fulani Heifers (in Milk) .. 6	1,745.8	10	2,822	Minimum 303 in 56 Maximum 5,722 in 376	242	Butter-fat testing not carried out. From experiments in the past a figure of 6½ per cent butter-fat is accepted as average for these breeds.	Butter-fat testing not carried out. From experiments in the past a figure of 6½ per cent butter-fat is accepted as average for these breeds.	441.1	7.9	4.7	In these herds a number of cows have been machine-milked but the majority have been hand-milked. Averages have this year been pulled down by machine milking.
W.F.Cows .. 139		25	3,423		276				10.3	6.6	
Total .. 145		35	3,251		264				9.4	5.8	
Sokoto Heifers (in Milk) .. 3	1,750.3	6	3,171	Minimum 811 in 138 Maximum 4428 in 360	285			422.5	9.1	6.0	
Sokoto Cows .. 60		10	3,467		265				10.3	6.9	
Total .. 63		16	3,356		271				9.9	6.6	

Notes :

1. Daily recording.
2. Calves weaned at 4 days.
3. Hand-milked cows milked 3 x for first six weeks, then 2 x. Machine milked cows 2 x.
4. Average ages of heifers at calving are as follows.—White Fulani (30) 3 years 11 months. Sokoto (11) 3 years 11 months.
5. Feeding.—Wet season : Bush grazing plus concentrates. Dry season : Mucuna hay, silage, guinea corn leaves, plus bush grazing plus concentrates. (Concentrates per gallon not readily ascertainable.)
6. Lactation figures above based on lactations of cows and heifers which had subsequently calved again before 31st March, 1953.
7. Column 11 determined by taking animals whose calving followed lactation fell between 1st April, 1952 and 31st March, 1953.
8. Four extraordinary lactations under 33 lbs. (all first calf heifers White Fulani) have been ignored, in columns 3 to 11.
9. Figures in column 2 (low), owing to large number of dry cows (at 3rd March, 1953 there were 111 dry out of 208).

Crops.—Shika rainfall was high and crops again excellent. The Guineacorn averaged $21\frac{1}{2}$ cwt, per acre, compared to 18 cwt the previous year.

5. *Daudawa Beef Herd*.—The slow progress of collecting and culling the initial herd goes on. As yet there can be little progress to report and records have been largely invalidated by a severe outbreak of Rinderpest in which 92 animals were lost. There are now 132 in the White Fulani herd including 51 cows and calving heifers, and 33 in the Sokoto herd with 20 cows.

6. *Cattle at Maiduguri and Yola Farms*.—The Shuwa herd at Maiduguri continued to give good yields, with 12 out of 21 cows recorded giving over 320 gallon lactations. The Yola herd is still in the process of initial selection ; there are now 7 promising cows.

7 *Cattle in tsetse country*.—Benue Province is now the home of the Ndama multiplication herd, 36 head of stock are maintained at Raav for multiplication with the object of producing sufficient bulls to upgrade the local dwarf shorthorn cattle. Experimental cross-breeding previously carried out shows that weight increases are more rapid and a larger beast results from this policy. Six Ndama bulls have been issued to owners of dwarf shorthorn herds for upgrading.

8. *Cattle Multiplication Centres*.—In order to make improved Shika stock available throughout the mixed farming areas a number of multiplication centres have been demarcated and work has been begun on buildings. They consist of 360 acres of land of which 60 is to be arable, with accommodation for 20 cows and a bull. Those begun during the year were situated in Katsina, Sokoto, Bauchi and Bornu Provinces. Facilities were already available in Kano and Zaria.

9. *Mixed Farming*.—The advisability of a change of policy was considered to inculcate the idea of a self-contained family holding, comprising pasture and grass fallow, as well as arable. In order to comply with such a policy new entrants would require to have at least 30 acres of farm land with 20 acres in one block, although a smaller acreage would be acceptable in Kano and Katsina provided that fertilisers are used to keep up fertility in place of fallows. Henceforward efforts will be directed to seeing that better methods of husbandry are followed, and that cows are available to the better farmers to breed up their own stock. The final numbers for 1952 are given with those of the preceding four years.

Year					No. started during the year	Failed during the year	Total at the end of the year
1948	..	..	..	..	1,018	366	4,720
1949	..	..	..	..	1,342	299	5,763
1950	..	..	..	..	1,577	288	7,052
1951	..	..	..	..	2,306	517	8,841
1952	..	..	..	..	2,869	767	10,943

10. *Poultry*.—Disease enters into the picture almost to the exclusion of all else. The main breeding station near Jos had to be closed owing to a rare type of staphylococcal skin infection. Yandev was hit by an epidemic of what may have been Newcastle disease though never confirmed as such. Policy has now been directed to cross-breeding with the local fowl before issue of stock, in order to produce some degree of improvement in size combined with hardiness to resist the many pests and diseases common to poultry all over the region. Some success has already been obtained on these lines in Gusau, Maiduguri, Zaria and Ilorin,

11. *Agricultural Shows*.—A number of shows are held annually in most of the provinces. Stock is the main item. There is keen competition and the condition in which cattle are brought to the shows, particularly in Katsina, is most praiseworthy. Produce on the other hand is usually poorly prepared. These shows are very popular all the same and have a high propaganda value, affording an opportunity for educative exhibits from all departments to be presented in an atmosphere of general goodwill.

12. *Pigs*.—A large white breeding herd of 66 sows and gilts was maintained at Shika. Two boars were imported from England at the beginning of the year. 61 animals were distributed for breeding purposes and 558 went for slaughter. This breed has done well commercially as instanced by Mr. K. Maroun's Kano piggery with an output of 4,657 bacon pigs during the year.

Pig-keeping is on the increase among the non-Moslem tribes. At Dass in Bauchi Province a Pig-keeper's Guild has been organised with an out-turn of 303 pigs. Southern Zaria is reported as railing 3,000 pigs annually to the south, but the conditions under which they are kept leave much to be desired.

13. *Fodders and Pastures*.—A Pasture Research Officer was appointed so that there should now be a prospect of collecting the information available and undertaking further research. A considerable amount of information on yields and treatments of pastures has been collected. An interesting conclusion from a 13 year trial of burning treatments at Ilorin is that annual burning suppresses spear grass which is a major component of the growth in the unburnt plots.

14. *Fertiliser*.—The distribution of superphosphate remained the responsibility of the Administrative Department while preparations were made for the Agricultural Department to take over on April, 1st 1953. The arrival of 12 newly recruited Production Officers early in 1953 made it possible. This was the last year for which large scale free issues were approved. Efforts are therefore being made to increase the number of small demonstrations and to follow-up sales individually as far as possible to see that the fertiliser is properly applied. Free issues proved wasteful on the whole. Figures for issues for the 1953 season will be included in the 1953/54 report.

FREE ISSUES AND SALES 1950-52

Year							Free issues ($\frac{1}{2}$ cwt bags)	Sales ($\frac{1}{2}$ cwt bags)
1950	..	..	..	..	..	..	30,000	—
1951	..	..	..	..	..	..	67,000	25,000
1952	..	..	..	..	..	..	32,000	22,000

SALES BY PROVINCES

Province							Bags sold 1951	Bags sold 1952
Adamawa	..	..	..	..	..	..	205	200
Bauchi	..	..	..	..	..	..	2,245	4,381
Bornu	..	..	..	..	..	..	3,375	3,160
Kano	..	..	..	..	..	..	2,348	3,815
Katsina	..	..	..	..	..	..	581	2,926
Sokoto	..	..	..	..	..	..	15,851	7,600
Zaria	..	..	..	..	..	..	344	1
							24,949	22,083

15. *Agricultural Training Centres*.—The Native Administration Farm School at Kafinsoli enrolled 32 pupils of Elementary School standard of whom only 16 remained to finish the course. The school farms have been reorganised into large fenced units of 32 and 36 acres including pastures and fallows.

16. *Soil Conservation*.—900 acres of Mixed Farmer's land was contour banded in Kano Province and other work was carried out on reclamation of a sheet eroded area at Badure (700 acres). A start was made on contouring the Kiru Settlement Scheme. In Plateau Province an interesting development has been the extension of the village scheme at Langtang by 500 acres. Here the people are giving willing co-operation in doing the work on their own land and preventing grass burning with excellent results. At Mujara in Adamawa Province villagers are also doing their own work in building up bunds on the contour over an area of 500 acres.

No organisation exists at present for assessing the value of the different types of work or giving an adequate training to Junior Staff. Until a man with training in Soil Conservation can be found, work can only be pushed forward by the individual efforts of Agricultural Officers assisted by Production Officers.

17. *Irrigation*.—Three prototype village irrigation schemes begun in Sokoto in the previous year were completed. The general attitude of villagers towards these schemes proved to be one of caution. Native Administration assistants have been trained in the use of water to oversee these projects on completion, but it will be some time before full use is made of them. A cattle dam and a low bund for flood control in the Sokoto River plain were also constructed.

Near Bida construction went ahead on the Edozhigi and Badeggi irrigation schemes. The headworks and distributaries of the Edozhigi scheme were completed for the most part but the bund designed to prevent inundation from the Kaduna River which will be 25,000 feet long was only half finished. Delays occurred through spares for earth-moving machinery being extremely difficult to obtain. None the less a considerable area of the 3,000 acres which will eventually be served by the scheme was cropped with rice this year. The headworks and some of the channels of the Badeggi scheme, which will eventually command 4,000 acres, were completed. Some 300 acres of established rice was saved from the effect of an early drought by the timely use of water from the first distributary. A scheme in which the local villagers are participating at Toroko is making slow progress owing to the sporadic supply of labour.

Three more Irrigation Engineers were recruited during the year. 10 trainees passed out of the Irrigation School at Sokoto and were posted as subordinate staff. One member of the Junior Staff was given a scholarship to study Civil Engineering and Irrigation at an Indian College.

After a long period of staff shortage in this section its expansion to full strength in the Senior Service is very welcome. It is disappointing therefore that Agricultural staff still remains at such a low ebb that it continues to be difficult to arrange for staff to supervise and investigate the uses to which schemes can be put, although a considerable amount of investigation has been done in both Sokoto and Niger Provinces.

18. *Mechanisation*.—The build-up of plant and staff has continued in the Engineering Branch. This is now capable of dealing with all maintenance and repair work with the exception of major electrical repairs for which no skilled electrician can be found. Implements have been made and a number modified to suit local conditions.

The problems of mechanical cultivation are still however only a stage nearer solution. Three Tractor Farms have been kept in operation and have yielded valuable information since it has been possible to place each one in the charge of a mechanic demonstrator. Some of the points of interest which have emerged are

- (a) One Ferguson tractor has been found capable of doing the cultivation on 150 acres of arable under mixed crops.
- (b) Weed-control is very difficult to establish in the early stages of cropping, due to the heavy concentration of work at the beginning of the rains.
- (c) Peak labour requirements for weeding and thinning guineacorn and cotton, picking cotton and lifting groundnuts are still unavoidable.
- (d) It is difficult to obtain high uniform yields from large acreages.

Of the crops grown on the farms only Guineacorn at Daudawa and Yams at Mbatie (Yandev) succeeded in covering direct costs and depreciation, excluding European supervision.

Some 200 acres of land was cultivated for farmers on a contract basis in Kano and Zaria. So far the demand for such a hire service has not been at all pressing.

19. *Mines Land Reclamation*.—A further 55 acres were levelled and composted, bringing the total of land treated to 325 acres. Difficulty is being experienced in obtaining surrender of mining leases to allow reclamation to proceed, owing to the high price of columbite.

20. *Land Settlement and Planned Farms*.—The necessity for a full preliminary survey and a greater measure of agronomic investigation followed by a 'pilot' stage, is being gradually realised in this region. Those settlements which have started on the least ambitious scale, leaving room to expand and improve technique gradually, are making progress, while those that plunged into mechanisation as a first step have found that lack of experience on those lines has proved a heavy handicap.

Another point which has been brought home is that settlers coming from overfarmed areas where the pinch of hunger has been felt are generally amenable to discipline and instruction. The alternative is careful selection of docile and intelligent individuals, who are by no means easy to find.

The Niger Agricultural Project with 160 settlers on 48 acre holdings had good yields of guineacorn. Groundnuts were badly affected by rosette. It has not yet proved possible to come near recouping costs of tractor-ploughing and mechanisation. Erosion is becoming serious.

Shendam has continued to make progress. Cattle are being introduced gradually. A start has been made on contour ridging by laying down grass strips.

The Jema'a settlement designed to accommodate Birom from the overcrowded parts of the Jos Plateau is still making little progress owing to their reluctance to move. Other tribes from adjacent hill country are being encouraged to come in.

The Kontagora Land Settlement Scheme run on Mixed Farming lines with cattle has not yet been able to produce a successful cash-crop owing to the unfavourable pest position for cotton and groundnuts. All the above schemes are financed by the Northern Regional Production Development Board and are described in their report.

At Daudawa, where over 80 settlers have been working for 10 years or more, the experience is that no relaxation in supervision is possible. Many of the farmers had fallen away sadly from their earlier standards and have had to be restored to them by an effort of reorganisation.

A number of other settlements are in operation in a pilot-scheme scale. Of these, three have been put down to test the validity of the 40 acre holding for Mixed Farmers, in Katsina, Bauchi and Bornu.

21. *Groundnuts*.—Although yields were not generally as good as in the previous year, the acreage planted was much higher due to the continued high price of £36 per ton. Comparative figures are as follows :—

<i>Province</i>	1951-52 (tons)	1952-53 (tons)
Kano	220,934	217,982
Katsina	63,727	66,815
Sokoto	42,610	48,199
Bornu	48,215	51,002
Bauchi	17,964	16,741
Adamawa	14,219	15,717
Zaria	5,300	7,816
Plateau	—	4,029
Other Provinces	5,286	2,395
	418,255	430,696

Seed Multiplication of the variety K 50 (a selection from MD 351) was continued at Danberta, distribution being made to 4,000 farmers. Improved seed was also grown at many departmental farms and sold for planting.

22. *Cotton*.—There was a further increase in the amount of Allen cotton seed distributed for planting :—

Cotton seed distribution in tons

Province	1948	1949	1950	1951	1952
Adamawa	—	17	22	31	160
Bauchi	346	442	550	867	1,208
Benue	40	40	60	30	42
Bornu	16	21	24	32	78½
Ilorin	—	—	—	—	1
Kano	387	388	498	585	747
Katsina	2,442½	2,666	3,315	3,828	4,224½
Niger	311	476	539	610	628
Plateau	34½	105	103	124	100
Sokoto	1,727	2,095½	2,856	3,358	3,910½
Zaria	1,164	1,325½	1,508	1,622	1,845½
	6,468	7,576	9,475	11,087	12,945

This year's distribution saw the completion of the first wave of 26C seed to Katsina, Sokoto and parts of Bauchi and Zaria. The remainder of the Allen Cotton acres will be covered in the 1953/54 season after which a second wave will begin in the first area. There are evidences of an increased lint percentage from the first wave from ginneries situated in that area.

Ginnery	Lint % 51/52 season	Lint % 52/53 season	Difference
Funtua	31.94	34.85	+2.91
Mallamfashi	31.00	34.07	+3.10
Gusau	30.24	33.43	+3.19
Mai Inchi	30.45	32.59	+2.14
Gombe	29.69	32.65	+2.96

The growing season was not so favourable as the previous one and planting was late in most districts. As a result the total purchases at the cotton-markets were only 77 per cent of the previous year's. Comparative figures over the last five years are :—

Purchases in tons of seed cotton.

Province	1948	1949	1950	1951	1952
Katsina	12,061	13,425	15,352	23,547	16,835
Sokoto	6,966	8,971	15,548	27,068	12,175
Zaria	4,992	5,908	5,965	8,133	9,008
Bauchi	413	1,072	2,011	4,502	5,602
Niger	776	1,847	1,673	2,010	1,522
Kano	—	—	60	36	907
Plateau	108	194	253	452	598
Adamawa	—	—	—	—	252
Bornu	—	—	—	—	142
	25,316	31,417	40,862	60,748	47,041

The reduction in yields has naturally reduced the return of seed cotton compared to seed distributed for which these figures are given.

Tons of seed cotton purchased per ton of seed issued.

Province	1948	1949	1950	1951	1952
Katsina	4.9	5.0	4.6	6.1	4.0
Sokoto	4.0	4.2	5.4	6.5	3.1
Zaria	4.3	4.4	3.9	5.0	4.9
Bauchi	1.2	2.4	3.6	5.1	4.6
Niger	2.5	3.9	3.1	3.2	2.4
Kano	—	—	—	—	1.2
Plateau	—	—	—	—	6.0
Adamawa	—	—	—	—	1.6
Bornu	—	—	—	—	1.8

23. *Sugar*.—The cane crop was again infected with Red-rot (the fungus *Colletotrichum Falcatum*) in the main growing areas of Zaria, Katsina, Kano and Eastern Sokoto, but there was no indication of an increase in its severity. A further importation of canes took place but it will be some time before their resistance can be tested and they can be multiplied up to a useful extent.

The sugar crushing industry operated by small horse driven crushers appears to have reached a state of equilibrium. Approximately the same numbers have worked for the last three years.

Province	1950		1951		1952	
	Crushers operating	Estimated output tons	Crushers operating	Estimated output tons	Crushers operating	Estimated output tons
Adamawa	9	54	17	75	18	120
Bauchi	11	120	18	120	21	150
Benue	—	—	—	—	1	$\frac{1}{2}$
Bornu	—	—	—	—	1	$\frac{1}{2}$
Kano	138	1,330	124	1,200	180	1,500
Katsina	102	1,750	113	1,940	95	1,425
Sokoto	103	527	87	539	108	837
Zaria	292	6,424	297	2,970	238	2,800
	655	10,205	656	6,744	662	6,833

24. *Virginia Tobacco*.—The Nigerian Tobacco Company greatly expanded their activities during the year and now maintain a considerable staff engaged in the extension and improvement of production. Final production was 68 per cent greater than the previous year. The main increases took place in Zaria and Sokoto Provinces. The overall average return is given as 287 lbs. leaf per acre, but this cannot be fully related to yields, which may be considerably higher.

25. *Soya Beans*.—The relative value of this crop having declined in comparison with that of groundnuts and benniseed with which it was in parity up to 1950-51, the incentive to plant has been reduced. There is no doubt however that soya beans constitute a valuable alternative cash crop in the Middle Belt and their production will continue.

Year						Purchase for Export (tons)	Price per ton
1950-51	..	..	..	..	..	3,510	£19
1951-52	..	..	..	..	..	8,035	£20
1952-53	..	..	..	..	..	3,884	£20

26. *Ginger*.—The curing of Ginger for export has been carried on in a small area of Southern Zaria since 1927. At that time the Jabas of Kachia district had no form of trade and were unable to find any cash with which to pay their tax. An export market was held for many years thereafter and the trade expanded and contracted according to the widely fluctuating prices prevalent in world markets. At the same time a flourishing local trade in green and split dry ginger sprung up, which eventually exceeded the export trade in the amount of ginger handled. In 1950-52 the export price rose from 5½d to 2s 6d per lb. causing a temporary boom in production. When the price dropped again to 5d at this year's market the producers and middlemen refused to sell and no ginger changed hands. As the local trade and an export in split dry ginger are now adequate to absorb all the ginger produced and the amount of cured ginger has gone down from 342 tons in 1936 to 50 tons and less in recent years, it was recommended that the gazetted market for cured ginger should cease and the regulations concerning marketing be revoked.

Figures for purchases over the last five years are given here.

Crop Year						Amount Purchased cwt.	£ Value (approx.)	Grade I Price per lb.	Grade II Price per lb.
1948-49	..	..	..	..	..	1,650	5,900	5½d	4½d
1949-50	..	..	..	..	..	533	6,100	23-27d	21-25d
1950-51	..	..	..	..	..	1,346	12,991	21d	19d
1951-52	..	..	..	..	..	1,145	15,600	30d	28d
1952-53	..	..	..	..	..	—	—	8-5d	6-4d

27. *Benniseed*.—Increased acreages were reported, but yields were low on account of heavy rains just before and during the main harvest period in August. There have been complaints of the quality of the crop as purchased due to undue admixture of sand and dirt. Efforts to counteract this by propaganda will be continued. The main producing areas are in Benue and Kabba Provinces. Purchases for export have continued to rise in response to higher prices.

Year						Purchases for export (tons)	Price per ton
1950-51	..	..	..	..	..	9,188	£19-20
1951-52	..	..	..	..	..	10,387	£32
1952-53	..	..	..	..	..	13,775	£36

Results of the selection carried out by the Botanist at Yandev are encouraging. Improved strains should soon be available for multiplication and distribution.

28. *Rice*.—Much work has been done in all Provinces on this crop. Multiplication and distribution of GC 79 and GEB 24, the two well tried medium water varieties, has increased and measures to maintain the purity of the seed are being taken.

Investigations into the mechanical ploughing of flats near Maiduguri indicated that yields were high and an economic scheme was possible. A survey showed that the true cost of preparation of the land by manual labour was in the neighbourhood of £7 per acre.

At Bida the effect of a severe drought was counteracted to some extent by the use of controlled irrigation water. Floods and drought in the Pategi area reduced yields. The rice mill there was successfully operated to hull 232 tons.

The Shemankar (Lowlands Division, Plateau Province) mechanical rice ploughing scheme had a successful year. Yields were good and an access to a ready market in Jos has made the scheme popular. Ploughing of 1,747 acres was completed for the 1953 season, with 3 new D4 Caterpillars and equipment furnished by the Production Board.

The Sokoto Rice mechanical cultivation scheme continued to deal with large acreages : 25,000 acres being under cultivation in 1952 and the target being 27,000 for 1953. From the 1952 acreage it is estimated that some 10,000 tons of hulled rice was raised and the year may be said to have been a very successful one.

29. *School of Agriculture, Samaru.*—The staffing and administration of this most important institution continues to make heavy demands on the Department. It has always been considered axiomatic that training should take priority over all other activities and that the foundation of a sound technical service of local recruitment was of the utmost importance.

Four classes consisting of 99 students were in training at the beginning of the year. Of these 17 were posted for duty on the completion of a three years course. 29 Native Administration assistants were given a one year course of training and separate courses for 12 Field Overseers were given in special subjects of direct value to their work, such as nursery technique, stock-keeping and labour organisation.

The new buildings in course of erection were not fit for occupation by the end of the year.

30. *Fruit Trees.*—Further nurseries continue to be established under Government or Native Administration and the number of trees distributed has now reached the very considerable total of 44,554 of all kinds, of which 15,864 were budded varieties of citrus and mango.

The most noteworthy development in this respect has taken place in the area around Maiduguri where fruit farming may now be said to have become an established industry.

Figures for distribution in the various provinces are given as far as recorded :—

<i>Province</i>	<i>Total issues trees (all kinds)</i>	<i>Budded stocks only</i>
Bauchi	1,600	1,600
Benue	4,068	4,068
Bornu	27,000	7,000
Ilorin	491	491
Kabba	10,123	1,433
Sokoto	212	212
Zaria	1,060	1,060
	44,554	15,864

31. *Experimental Work.*—The work undertaken by the Research services of the Department is given at considerable length in the Research Adviser's report. Suffice it to give a short general picture of the service.

Considerable progress has been made during the year in the reorganisation of the Research Services of the Department centred at Samaru. The various specialist sections have been combined into a research team under the direct administration of an Principal Agricultural Officer who is responsible for the implementation of the Director's research policy. A pathology laboratory is approaching completion and it is expected that a new Botanist with training in Pathology due to arrive during 1953, will be able to make a start on long overdue investigations of plant diseases of the Region.

Pasture Research Section.—A Pasture Research Officer was appointed during the year and has been making preliminary studies with material already available. A policy is being worked out which will be directed mainly towards discovering the best types of grasses and legumes, methods of establishment and methods of management of pastures suitable for the grazing areas required in the new type of Mixed-Farmer's holding. This problem will be given priority, but many other aspects of pasture work and fodder production will be investigated.

Botanical Section.—The Botany section has continued to give priority to work on Groundnut and Guineacorn breeding and selection. Seventeen new varieties of Groundnuts from Indonesia and French Congo were introduced for multiplication and trial, and a further collection of existing Nigerian strains from all parts of the Region was made for further selection work. Special prizes were offered at Agricultural Shows for outstanding Groundnut plants which may lead to the acquisition of important new breeding material. Breeding work on Bennisced also continued, and limited work was done on Rice, Cassava, Tobacco and minor crops. Special attention has had to be paid to the rapid spread of Red Rot disease of Sugarcane, and importation of new varieties and testing their resistance to this disease is at present in hand. In addition, investigations of field techniques for limiting the rate of spread of the disease are in progress. The Section continues to suffer from extreme shortage of Senior Service Staff and its activities will necessarily be limited until this can be rectified.

Cotton Section.—The Cotton section, staffed by the Empire Cotton Growing Corporation, continued to make steady progress. The new nucleus stock of the selected strain Samaru 26C has continued to give most satisfactory results in tests, showing an advance on the older stocks in both yields and quality.

New reselections promising a further substantial increase in yield with greater resistance to pests and disease are under trial and the best will be entering the first stage of seed multiplication next season.

The advantage in yield obtained by replacing the old Allen stocks by the existing bulk stocks of Samaru 26C has been shown to exceed 15 per cent. When stocks of the new sub-strains have been built up a considerable further improvement can be expected.

The multiplication scheme at Daudawa has been improved and consolidated and a subsidiary scheme has been started at Gombe to provide seed for Bauchi, Adamawa and Bornu Provinces.

Entomological Section.—Promising results have been obtained with measures to control insect pests by sprays and dusts applied to small experimental plots but the problem of how to apply insecticides to the cultivators' farms safely and economically at the correct time has not yet been solved. Further knowledge has been gained of the life history of insect pests without which effective control measures cannot be devised.

Chemistry Section.—The Chemistry section continued the standard series of trials incorporating Farmyard Manure with Nitrogenous, Phosphatic and Potassic fertilisers which were started in 1949. The original trials are at Daura, Sokoto, Kano, Daudawa, Samaru, Bida, and Yandev and later ones (started in 1951) at Yola and Maiduguri. In spite of the fact that annual dressings of superphosphate are far in excess of the amounts advised for farmer's use, no detrimental effects have yet been observed.

The experiments have confirmed that the large responses to Farmyard Manure are mainly due to its phosphate content, and so far, no response has been obtained anywhere to potash.

A number of trials incorporating Nitrogenous and Phosphatic fertilisers were laid down on peasant holdings in Plateau Province and on Yola Government Farm. The results have not yet been analysed.

A new series of experiments designed to ascertain the effects of applications of sulphate of Magnesium, Calcium and Sodium was started at four stations, Kontagora, Damberta, Yola and Samaru. Visual effects in greener and more vigorous growth have been noted, but yields have not yet been analysed.

Experiments using Farmyard Manure which has been fortified during its production by the addition to it of superphosphate have been carried out at nearly all stations. Results to date show small increases due to fortifying the manure, and indicate that superphosphate applied in this manner may be more effective than the same quantity applied direct to the soil.

A large scale set of twenty-seven trials with fertilisers on Yams, Guineacorn, and Maize were laid down in Ilorin Province, in order to assess the responses to fertilisers in that area. Full results are not yet available.

The Chemistry Section has also carried out experiments on placement and time of application of fertilisers to various crops. Analysis of feeding stuffs, fodders and silage in connection with the nutrition of livestock are regularly carried out in the Samaru laboratory, in addition to soil sample examinations to determine the soil characteristics of special areas. Investigations into the possibility of minor element deficiency in such crops as citrus and neem are also being conducted by means of pot experiments and leaf paintings.

Agronomy Section.—The Agronomy Section, which has existed in nucleated form for several years, has now been placed under a Senior Service Officer. His most immediate duty will be to summarise and assess the results of past experiments on crop agronomy in the Northern Region, and subsequently to take responsibility for the supervision of such trials at all stations.

A series of experiments at seven stations in the north of Kano Province has completed its third year. These experiments were designed to test the geographical limits of the usefulness of the new variety "Kano 50" (or "Yar Hamsin") which it was thought might not be better than the local spreading variety in the extreme north. These experiments have shown that "Yar Hamsin" is, over a period of years, better throughout the area than the local variety, though the superiority is less marked at Kazaure and Mallam Maduri than at more southerly sites (Taura, Gwarzo, Dambarta, Wudil and Kano). The trials also showed that cultivation on the ridge gives higher yields whatever the variety, than flat cultivation, but again the difference is less marked in the northerly areas.

A number of short Guineacorns of American origin were tried once more at several stations, but in their present form these show little promise. They may, however, prove useful for further breeding work.

Experiments on pasture, and fertility maintenance by means of fallow crops, were continued at nine stations.

AGRICULTURAL DEPARTMENT NORTHERN RESEARCH STATION, SAMARU, ANNUAL REPORT 1952-53

PART I.—GENERAL INTRODUCTION

By J. H. Gisborne

During the year, the final steps have been taken in the unification of the various specialist sections into a single organisation under the direction of the Principal Agricultural Officer. The organisation now consists of—

Principal Agricultural Officer, in charge of research and administration.

Station Manager, responsible (a) for routine administrative duties in the office and

(b) for outside work of a non-agricultural nature (station maintenance, transport, etc.).

Agronomy Section, responsible for agricultural operations, livestock and agronomic investigations on Samaru farm ; also for the general supervision of agronomic trials at outstations, and the calculation, summarising and presentation of their results.

Botany Section, responsible for plant introductions, breeding and selection work and variety trials of all crops (except cotton and pasture plants) both at Samaru and at outstations.

Chemistry Section, responsible for soil and fertiliser work and analyses.

Pasture Section, responsible for work on pasture, forage and fodder crops throughout the Region.

Cotton Section, responsible for all breeding, selection, introduction, pathology and entomology of cotton. Advisory duties on general aspects of cotton in Northern Nigeria and the seed multiplication and distribution scheme.

It will be observed that the duties of the old post of Agricultural Officer, Samaru have been divided between the Station Manager and the Agronomist, and that the latter has, in addition, taken over the outstation work previously supervised by the Principal Agricultural Officer.

The filing and accounts system for the station have been centralised under the Station Manager, who also deals with routine staff matters, and this reorganisation has considerably decreased the amount of routine office work which previously fell on the individual specialists.

The present report, being the first from the unified station and also the first available for general distribution, has gone into rather more detail on past results than would normally be the case, as it will form a basis for back reference in future annual reports.

STAFF

Lists of established staff in all sections appear as Appendix I of this report.

The Senior Staff position has improved slightly. Agricultural Officer, Samaru was replaced late in the year by two officers—an Agronomist and a Station Manager—and a third (an Assistant Station Manager) was available for part of the time. The Chemistry section was again brought up to strength (two Chemists), and a Pasture Research Officer assumed duty late in the year. The position is, however, still not satisfactory, the Botany section in particular being quite inadequately staffed, and entomological problems (other than those of cotton) and pathology are virtually not touched at all.

The Junior Staff promises to be strongly reinforced in June-July, 1953 by the posting practically *in toto* of a class graduating from the School.

VISITORS

Visitors from abroad included (in chronological order) :

Col. Johnston, Member of the Colonial Agricultural Machinery Advisory Committee.
 Sir Alan Hitchman, Secretary to the Ministry of Materials.
 Mr J. W. Purseglove, Lecturer in Tropical Agriculture, Cambridge University.
 Messrs Avery of Fisons and Zee of the Dutch Albatross fertiliser firm.
 Mr E. Carey, Assistant Editor of "West Africa".
 Mr J. C. May, Director of the Empire Cotton Growing Corporation.
 Mr D. Stephens, Chemist of the Gold Coast Department of Agriculture.
 Mr A. G. Nye, Deputy Agricultural Adviser to the Colonial Office.
 M J. B. Roux, Chief of the Cotton Research Station, Bebedjia, Tchad.
 MM Galichet and Gutknecht of M Roux' staff.
 Professor E. E. Edwards of Achimota College, Gold Coast.
 Messrs Cowan and Murray of Plant Protection Limited.
 Mr R. W. Piper of the Colonial Office.

Visitors from within Nigeria were too numerous to list.

M J. L. Renouleau, Agronomist of the I.R.H.O., Paris, spent the period May, 1952 to March, 1953 at Samaru, studying groundnut cultivation and methods in Nigeria prior to taking up his duties at Niangoloko, Haute Volta.

MISSIONS

A mission sponsored by the Overseas Territories Committee of the O.E.E.C. visited Nigeria in August-September, 1952. The mission's function was to study the cultivation of groundnuts in West Africa and the methods used for plant breeding and improvement, and consisted of :

Dr B. B. Higgins, U.S.A., leader of the Mission.
 Mr G. G. Bolhuis, Holland.
 Mr L. M. Bologna, Italy.
 M E. E. de Preter, Belgium.
 M I. Bouffil, French Senegal.
 Mr R. A. Neve, Gold Coast.

The Mission was accompanied during its stay in Nigeria by Mr A. R. Maurer, Botanist, of this station. In addition to four full days spent at Samaru, the Mission visited the main groundnut growing areas of the North and spent some time at Ibadan also. Valuable information was obtained on the methods favoured in the countries represented by the members of the Mission : their report has not yet been received at Samaru.

METEOROLOGICAL DATA

The following data were recorded at Samaru in 1952 :

<i>Month</i>	<i>Rainfall 1952 ins. (days)</i>	<i>Rainfall 1924-51 ins. (days)</i>	<i>1952 Mean R.H. per cent</i>	<i>1952 Mean Max. °F</i>	<i>1952 Mean Min. °F</i>	<i>1952 Mean Temp. °F</i>
January ..	0.00 (0)	0.00 (0)	28.7	89.2	58.3	73.8
February ..	0.00 (0)	0.04(0.1)	17.6	92.6	60.8	76.7
March ..	0.14 (1)	0.32(0.8)	25.7	97.3	68.8	83.1
April ..	0.13 (1)	1.26 (3)	38.3	101.4	74.3	87.9
May ..	5.09 (11)	4.94 (11)	60.7	93.8	67.2	80.5
June ..	6.27 (12)	6.42 (13)	66.8	90.4	68.9	79.7
July ..	13.02 (23)	8.68 (17)	79.1	83.6	67.0	75.3
August ..	8.04 (15)	11.57 (22)	82.2	81.3	68.0	74.7
September ..	9.00 (17)	8.62 (17)	79.0	84.5	67.7	76.1
October ..	1.82 (5)	1.43 (4)	64.7	87.9	66.5	77.2
November ..	0.00 (0)	0.03(0.2)	30.8	89.4	60.7	75.1
December ..	0.00 (0)	0.01 (0)	57.6	87.1	57.8	72.5
Total ..	43.51 (85)	43.32 (88)	—	—	—	—

A dry spell from late May to mid-June retarded planting (except for millet) and adversely affected the earliest guineacorn plantings, necessitating heavy supplying. During the third quarter, rainfall was above average, that for July being the heaviest for that month since records were started in 1924. A certain amount of waterlogging occurred and this retarded growth for a time. Final yields in most crops were lower than average.

During the year, in co-operation with the Department of Geography, University College, Ibadan, an evapo-transpirometer was installed and maintained at Samaru and another at Daura. This apparatus is designed to measure water losses by evaporation and transpiration from an area of soil planted (at present) with grass (*Cynodon dactylon*). All figures recorded are forwarded to the Department of Geography, which maintains other evapo-transpirometers in the Eastern and Western Regions, and publishes periodical reports.

Interesting data are being produced which should be of the utmost value in the future in particular in assessing water requirements for irrigation.

BUILDINGS

The following were completed during the year :—

Senior Service Quarters : two A53 quarters ; three Semi-permanent quarters.

Offices and Laboratories : one pathology laboratory, with subsidiary offices, dark room and photographic studio. One block of five offices for administration and office staff. One cotton ginner^y and store.

II.—AGRONOMY SECTION

By E. J. Butler

A.—GENERAL

The Agronomy section which has existed in a skeleton form for some time expanded during the last quarter of the year, when a Senior Agricultural Officer was posted to the section. In its expansion, the section took over the agricultural duties and some of the staff of the former Agricultural Officer, Samaru.

FARM

The area under cultivation was 48.57 acres of experiments and 134.18 acres non-experimental, giving a total of 182.75 acres. This acreage included the main farm and the extensions, some detached areas in Samaru, Bomo Farm and Shika (Optimum types of fallow). In the main farm there were several patches of waterlogging caused by the heavy rains in July (13.02") and August (8.04"). More patches of waterlogging occurred in the striga-guineacorn experiment than in any other and proved the site unsuitable. Crop growth in general was normal and the yields were satisfactory.

CATTLE

The policy of grading the Zebu (White Fulani) to the N'dama was continued. The N'dama-Zebu herd consisted on 31-3-53 of the following animals :—

Class	NZ x N	NZ x Z	Z	NZ	N	Total
Cows	—	—	13	23	—	36
One to three years old bulls ..	4	1	3	20	—	28
One to three years old heifers ..	2	—	—	12	—	14
Bull Calves	5	5	—	13	—	23
Heifer Calves	3	3	—	17	—	23
Stock Bulls	—	—	—	—	4	4
Total	14	9	16	85	4	128

Where N represents N'dama and Z, Zebu. Except for a few cases of Tryps the general health of the herd was satisfactory.

EXPERIMENTS REPORT

Throughout this section, the following symbols are used to indicate significant differences

x	Significant at P=.05
xx	„ P=.01
xxx	„ P=.001

Appendix II gives the mean monthly rainfall figures for the outstations, and Appendix III is a map showing their locations.

MILLET (PROJECT 700)

Work on millet was confined to a Spacing cum Variety Trial at Sokoto. The four varieties were Zango, the common local variety, Gergera and Wuyan Bajimi which are grown locally to a small extent and Bornu White, an introduced variety. The spacings on 3' ridges were 3', 4½' and 6'. The first is the usual local spacing when millet is planted as a sole crop and the last is that used when interplanting with guineacorn.

The crop received two tons F.Y.M./acre.

					Yields lb. threshed grain/ac.		
Varieties					Not Sig.	Spacings	Not Sig.
Wuyan Bajimi	..	..	..	..	549	3'	597
Zango	..	..	..	..	540	4½'	505
Gergera	..	..	..	..	538	6'	496
Bornu White	..	..	..	..	502	S.E.	±36
S.E.	..	..	..	..	+41	—	—

Interaction.—Not Sig.

					3'	4½'	6'
Wuyan Bajimi	..	..	..	..	624	552	472
Zango	..	..	..	..	603	540	478
Gergera	..	..	..	..	495	529	591
Bornu White	..	..	..	..	667	397	443

There was very little difference between varieties. The wider spacings caused a marked drop in yield though this was not significant. This drop would have been greater but for the variety Gergera which reversed the trend by giving higher yields with wider spacings. Although the experiment was not significant, it seems clear that when the common local variety, Zango is sown as a sole crop the normal local spacing of 3' is the optimum.

GROUNDNUTS (PROJECT 701)

(1) *Spacing of spreading groundnuts.*—A spacing experiment on Local Spreading groundnuts was carried out at Kafinsoli for the third year. There were two widths of ridge,—2½' and 3'. The spacings on the ridges were 6", 9" and 18".

Yields in lb. kernels/acre were as follows :—

					1952	1951	1950
Spacing on Ridge					Not Sig.	x	xx
6"	..	..	..	..	597	—	—
9"	..	..	..	..	564	1,206	1,220
18"	..	..	..	..	552	1,321	1,035
27"	..	..	..	..	—	1,214	915
S.E.	..	..	..	..	±23	±29	±49
Sig. Diff. 5%	..	..	..	..	—	84	147
Sig. Diff. 1%	..	..	..	..	—	—	203
Width of Ridge					x	Insig.	xx
2½'	..	..	..	..	606	1,235	1,139
3'	..	..	..	..	536	1,259	972
S.E.	..	..	..	..	±19	±23	±40
Sig. Diff. 5%	..	..	..	..	54	—	119
Sig. Diff. 1%	..	..	..	..	—	—	165

Yields in 1952 were poor as the site was clayey and waterlogged readily. The results over the three years confirm those already obtained with upright varieties that yields are increased by closer spacing than is normally used in Nigeria.

(2) *Methods of Planting Groundnuts.*—A trial was carried out at Maigana on the effect of planting groundnuts in shell. This was prompted by the fact that when planting on a big scale as in mechanised schemes shelling seed by hand is expensive both of money and of time. The treatments were (a) Seed shelled by hand (b) Seed in shell soaked for forty-eight hours (c) Dry seed in shell cracked by rolling between finger and thumb.

Yields in lb. shelled nuts/acre were as follows :—

	<i>Treatment</i>					<i>Not Sig.</i>
Shelled Seed	..	..	..	..	..	689
Seed in shell, soaked	..	..	..	..	..	748
Seed in shell, cracked	..	..	..	..	..	726

The planting rains were good and under these circumstances the methods seem equally satisfactory. It is relevant that in a previous trial at Kontagora where shelled seed was tested against dry seed in shell and seed in shell soaked for six hours and the planting rains were bad the germination of the shelled seed was vastly superior to the others. A trial at Maigana in 1951 was of little value as, due to the supervention of a drought, the seed was soaked for seven instead of two days. In spite of this much of it germinated and gave a yield of 324 lb. per acre compared with 510 lb. for shelled seed.

(3) *Behaviour of Groundnut Variety Kano 50 in different localities.*—Trials were carried out in seven localities in Kano Province to test the suggestion that the superiority of variety Kano 50 (MD. 351) might disappear in the Northern Zone and whether in this zone flat cultivation might not be better than ridged. The sites were at Kano, Wudil, Taura, Gwarzo, Dambatta, Kazaure and Mallam Maduri. The control variety was the Local Spreading type commonly used in each district.

Yields in lb. shelled nuts/acre were as follows for six of the seven trials. That at Mallam Maduri failed.

				<i>Kano</i>	<i>Wudil</i>	<i>Taura</i>	<i>Gwarzo</i>	<i>Dambatta</i>	<i>Kazaure</i>
Varieties	..	..	..	Not Sig.	Not Sig.	Not Sig.	Not Sig.	xx	Not Sig.
Kano 50	..	..	..	431	407	553	309	449	875
Local	..	..	..	431	446	447	336	323	863
Cultivations	..	..	..	x	xx	Not Sig.	Not Sig.	x	Not Sig.
Ridge	..	..	..	496	522	530	348	435	882
Flat	..	..	..	365	330	470	298	336	856
S.E.±	..	..	..	40	34	43	33	27	80

Varieties.—This is the third year of the experiment. When the yields over the localities are combined there is little to choose between the varieties as the following table shows :—

			1952	1951	1950
			Not Sig.	x	Not Sig.
Kano 50	..	..	504	699	643
Local	..	..	474	747	609
S.E.±	..	..	18	16	17

The interaction of Districts x Varieties was not significant in 1952. In 1951 it was significant at 1 per cent when Local was better at Wudil, Kazaure and Mallam Maduri. In 1950 it was significant at 5 per cent when Local again was better at Kazaure.

Cultivations.—Ridged Cultivation is clearly superior to Flat over the area. Combined yields were as follows :—

			1952	1951	1950
			xx	Not Sig.	xx
Ridged	..	..	535	734	673
Flat	..	..	442	712	579
S.E. $\pm$	..	..	18	16	17

The interaction of Varieties and Cultivations was not significant except in 1951 when the decrease in yield on the flat was significantly less at 5 per cent in the case of Local than with Kano 50. It is clear that both varieties prefer ridged cultivation. The interaction of Cultivation and Districts was significant at 5 per cent in 1950 and 1951 but not in 1952. This was not due to flat cultivation being superior in any district but to its depressing effect being less marked. The districts showed no regularity in this respect from year to year. To sum up :—

- Ridged Cultivation is better than flat in most districts and is at least as good in the remainder.
- Both varieties do better on the ridge.
- There is little to choose between the varieties taking the combined yields but there is in fact evidence that Local Spreading may be the better further north.

This last conclusion is disturbing : since 1938, Kano 50 (earlier reported by the plant breeding number MD. 351) at Kano itself has been consistently very much more high yielding than the Local Spreading variety, the increase being, on the average, of the order of over 20 per cent kernels. If the foregoing results are confirmed by further trials, it will be necessary to reconsider the distribution policy for this variety. It should be pointed out, however, that these provincial trials in Kano Province has so far been unsatisfactory : in several cases very unsuitable and atypical sites have been used ; and supervision has been of a low standard owing partly to inaccessibility in the wet season, and partly to the absence of high grade staff to carry out the supervision. Efforts are being made to remedy these defects in 1953.

GUINEACORN (PROJECT 720)

(1) *Control of Striga by Trap Crops.*—A trial was carried out at Bauchi to test a South African report that Cowpeas and Sunflower cause *Striga Lutea* to germinate and then die in the absence of its proper host. The species attacking Guineacorn in Nigeria is *S. senegalensis*. These crops were planted in 1951 with two groundnut treatments as control. In the following year striga was hand weeded from one of these and left in the other to see if weeding out the parasite would increase yield.

Results were as follows :—

						<i>Striga</i> counts/acre	<i>Yield lb.</i> <i>threshed</i> <i>corn/acre</i>
		<i>Treatments</i>				xx	xx
After groundnuts.	Striga left	..	..	..	..	111,012	350
After groundnuts.	Striga weeded	..	..	..	..	154,072	480
After Cowpeas	..	..	..	..	..	114,656	624
After Sunflower	..	..	..	..	..	126,324	249
S.E.	..	..	..	..	..	$\pm 8,124$	± 74
Sig. diff. 5 per cent	..	..	..	..	..	23,573	214
Sig. diff. 1 per cent	..	..	..	..	..	31,833	289

The striga counts are the important figures in this experiment. The only significant difference is between the two groundnut treatments possibly due to the fact that weeding reduced the chances of two plants being counted as one. But there is no evidence that cowpeas or sunflowers are of the slightest use as trap crops. In an experiment reported separately by the Botanist the same result was obtained.

In the groundnut treatments hand pulling striga increased yield by 130 lb. but this increase was not significant.

(2) *Effect of Striga on Yield.*—Experiments were carried out at Samaru, Daudawa and Yandev to see to what extent, if any, Striga reduced the yield of guineacorn, how this is affected by manuring and whether repeated manuring reduces Striga incidence.

(a) At Samaru there were sixteen combinations of the following treatments :—

O.v. 3 tons/acre Farm Yard Manure.

Striga weeded v. not weeded.

Infection with Striga v. non-Infection.

Transplanting v. Sowing Guinea-corn.

The intention of the last two treatments was to ensure striga infection where it was wanted with striga seed which had been collected the previous year.

Yields in lb. threshed corn/acre were as follows :—

<i>Manure</i>			xxx	<i>Transplanting</i>			xxx
Nil	..	..	337	Transplanted			314
3 tons	..	..	739	Not transplanted			763
<i>Eradication</i>			Not sig.	<i>Infection</i>			Not sig.
Weeded	..	..	484	Infected			514
Not weeded ..	..	..	593	Not infected			563

Interactions

Infection × Manure Sig. 5% Sig. diff.=180

							<i>Not infected</i>	<i>Infected</i>
Nil	..	..	..	..	..	..	299	376
3 tons ..	..	..	..	..	..	..	827	651

No other interaction was significant.

The experiment was unsatisfactory. The site suffered from waterlogging and yields were mediocre. Artificial infection by striga was not very high as shown by the average green weight of striga per acre weeded from the eradication plots of 7.12 lb/acre and the following count of infected plants on artificial infection plots :—

<i>Treatment</i>						<i>Total Stands</i>	<i>Total Infected</i>	<i>Percentage infected</i>	<i>Mean</i>	<i>Mean</i>
F.Y.M.	..	..	..	..	..	573	46	8.03	6.62	8.91
No F.Y.M.	..	..	..	..	..	606	32	5.28		
F.Y.M., transplanted	..	..	..	..	..	634	91	14.35	11.80	
No F.Y.M., transplanted	..	..	..	..	..	298	19	6.38		

Although infection was slightly higher on transplanted plots, this treatment is inconvenient, and will be omitted in 1953, efforts being made to ensure infection with ordinary sowing. Only one interaction, Manure × Infection, was significant which showed that a much larger increase of yield was obtained by applying manure to non-infected than to infected corn but confirmation of this is needed.

(b) *Daudawa.*—The experiment at Daudawa was not analysed as striga counts showed the site to be almost completely free of the parasite.

(c) *Yandev*.—At Yandev no attempt was made to infect the corn reliance being placed on natural infestation. Treatments were as follows :—

Manure : O v. 3 v, 10 tons F.Y.M./acre.

Eradication : Striga handweeded v. not weeded.

Yields in lb. threshed corn/acre were as follows :—

	<i>Manures</i>				xx	<i>Eradication</i>				<i>Not Sig.</i>
10 tons	..	..	..	..	659	Weeded	..	..	..	525
3 tons	..	..	..	..	432	Not weeded	..	..	..	421
0 tons	..	..	..	..	325	S.E.	..	..	..	±32
S.E.	..	..	..	..	±46					
Sig. diff. 5 per cent	..	..	..	..	144					
Sig. diff. 1 per cent	..	..	..	..	205					

The interaction of manures and eradication was not significant. Nothing can be said of this experiment to-date other than that there is no evidence to show that hand pulling of Striga has any beneficial effect on the yield of guineacorn. The manurial treatment is, of course, not expected to show an effect on striga population in the first year.

(3) *Methods of Sowing Guineacorn*.—As the normal practice of planting guineacorn by hand at intervals on 3' ridges is inconvenient for mechanical cultivation different methods of sowing were tried, some of which simulated mechanical planting, to see the effect, if any, on yield. The experiment was carried out at Kafinsoli and treatments were as follows :—

PL Plant on large ridges in the usual way.

DL Simulate drilling on large ridges and thin to 2'

PS Plant on small ridges in the usual way, and later ridge up.

DS Simulate drilling on small ridges and thin to 2' and later ridge up.

PF Plant on the flat and later ridge up.

DF Simulate drilling on the flat, thin to 2' and later ridge up.

In the "Simulate Drilling" sowing, one seed was dropped about every 2" and the stands later to be thinned to about two plants every 2'. In actual fact this treatment was in error thinned to one plant every 2' which makes it difficult to compare with planting in the usual way where approximately 2 plants were left per stand 2' apart on the ridge.

Yields in lb. threshed grain/acre were as follows :—

<i>Treatments</i>					
PL	..	..	..	..	1,255
PS	..	..	..	..	1,083
DS	..	..	..	..	1,044
DL	..	..	..	..	839
DF	..	..	..	..	800
PF	..	..	..	..	691
S.E.	..	..	..	..	±95
Sig diff. 5 per cent	..	..	..	..	271
Sig diff. 1 per cent	..	..	..	..	364

As already mentioned no fair comparison may be made between drilling and planting. But the fact that sowing by either method on the flat is disadvantageous emerges fairly clearly.

COTTON (PROJECT 708)

(1) Variety cum Sowing Date trials were carried out at Yandev and Ilorin. At both stations the yields were so poor that the relative figures are of little value. Yields in lb. seed cotton/acre were as follows :—

							Ilorin	Yandev
Variety	..	..	..	..	..	..	xx	Not sig.
26C	..	..	..	..	..	..	118.5	30.3
Local	..	..	..	..	..	..	42.2	54.8
Bar 4/16	..	..	..	..	..	..	34.7	22.0
Bar D28 (BCP)	..	..	..	..	..	..	67.5	—
S.E.	..	..	..	..	..	..	±9.02	±18.82
Dates	..	..	..	..	..	..	x	Not Sig.
June 16	..	..	..	..	..	..	77.7	Late May 35.0
July 7	..	..	..	..	..	..	71.7	Mid June 43.7
July 28	..	..	..	..	..	..	47.8	Early July 28.5
S.E.	..	..	..	..	..	..	±7.82	±18.82

Bar D28 (BCP) was omitted from the Yandev analysis because of its low stand count. It gave 35.7 lb. seed cotton per acre.

(2) *Spacing cum Sowing Date*.—There is ample evidence regarding the optimum sowing date of cotton in an average season. It is intended by long term experiments to find out how the optimum date is affected by different seasons and how it interacts with spacing at different levels of fertility. As much of the Nigerian crop is planted later than the optimum date, it is desirable to discover whether a modified spacing is required for such late plantings. The experiment was carried out at Samaru and Daudawa. Different fertility levels were obtained by applying O.v. 3 tons F.Y.M.

Spacings were 9", 18" and 27" on 3' ridges.

Planting dates were June 20, July 7, August 1 and August 22.

Yields in lb. seed cotton/acre were as follows :—

MAIN EFFECTS

							Samaru	Daudawa
<i>Soil Fertility</i>							xxx	Not sig.
No Manure	..	..	..	..	..	..	288	280
3 tons F.Y.M./acre	..	..	..	..	..	..	470	422
S.E.	..	..	..	..	..	..	±11	±47
<i>Sowing Dates</i>							xxx	xxx
20th June (d1)	..	..	..	..	..	..	522	554
11th July (d2)	..	..	..	..	..	..	548	335
1st August (d3)	..	..	..	..	..	..	330	321
22nd August (d4)	..	..	..	..	..	..	116	194
S.E.	..	..	..	..	..	..	±21	±27
Sig. diff. 5 per cent	..	..	..	..	..	..	66	76
Sig. diff. 1 per cent	..	..	..	..	..	..	92	101
Sig. diff. 0.1 per cent	..	..	..	..	..	..	130	125
<i>Spacing</i>							Samaru	Daudawa
							Not sig.	Not sig.
9"	..	..	..	..	..	..	398	359
18"	..	..	..	..	..	..	376	354
27"	..	..	..	..	..	..	366	345

Interactions. No interaction was significant.

The figures for the two experiments agree closely except for the second date of planting. Three tons F.Y.M. per acre gave large increases in yield but the increase was significant at Samaru only, as the experiment was not designed to bring out this well known effect. The

wider spacings reduced yield but only very slightly. In both trials the effect of planting dates was highly significant. At Samaru d1 and d2 did not differ and both were better than d3 and d4 at 0.1 per cent. d3 was better than d4 at 0.1 per cent. But at Daudawa the second date of planting did comparatively badly. d1 was better than all others at 0.1 per cent. d2 and d3 were much the same and both were better than d4 at 0.1 per cent.

Leaf Tattering.—The Samaru experiment was also intended to provide material for observations on leaf tattering ascribed to *Campylomma*. There are indications that all three factors influence the degree of tattering and it may be possible to show that bad tattering can be avoided by wider spacing when sowing early on soil of good fertility.

The plots were marked by eye for tattering on a scale of 0 to 7 and transformed for statistical analysis by the formula $\sqrt{(x + \frac{1}{2})}$ where x is the average tattering per plot.

Estimates of Tattering were as follows :—

MAIN EFFECTS							
<i>Soil Fertility</i>							xxx
3 tons F.Y.M.	..	..	..	..	..	..	60.79
No Manure	..	..	..	..	..	..	48.77
S.E.	..	..	..	..	..	..	± 1.355
<i>Sowing Dates</i>							xxx
20th June (d1)	..	..	..	..	..	..	33.33
11th July (d2)	..	..	..	..	..	..	33.53
1st August (d3)	..	..	..	..	..	..	25.53
22nd August (d4)	..	..	..	..	..	..	17.13
S.E.	..	..	..	..	..	..	± 0.782
Sig. diff. 5 per cent	..	..	..	..	..	..	2.41
Sig. diff. 1 per cent	..	..	..	..	..	..	3.39
<i>Spacing</i>							xxx
9"	..	..	..	..	..	..	39.71
18"	..	..	..	..	..	..	35.41
27"	..	..	..	..	..	..	34.44
S.E.	..	..	..	..	..	..	± 0.693
Sig. diff. 5 per cent	..	..	..	..	..	..	2.00
Sig. diff. 1 per cent	..	..	..	..	..	..	2.70

Interactions. Dates x Fertility Sig. 5 per cent.

					d1	d2	d3	d4
Nil	..	..	..	..	15.64	14.50	10.60	8.03
3 tons	..	..	..	..	17.69	19.03	14.97	9.10

No other interaction was significant.

The increase of tattering with high fertility is very marked. There is little difference between the first two dates of planting after which tattering decreases by amounts significant at 0.1 per cent. Spacing at 9" had more tattering than 18" and 27" significant at 0.1 per cent. The two latter did not differ significantly.

The interaction of dates and fertility was significant at 5 per cent due to increased tattering of the second date of planting at the high fertility level as compared with a decrease at low fertility. It is of interest that this trend is very similar to that of the yield figures where the effect approached significance. The indication is that the insects causing tattering have a preference for healthy well-grown cotton plants.

SOYA BEANS (PROJECT 713)

Spacing Trial.—A spacing trial of Soya Beans was carried out at Riyom. The spacings were 2", 6" and 12" on 3' ridges.

Variety : Dixie.

Manure : Nil.

Yields in lb. threshed seed/acre were as follows :—

Spacing	Not Sig.
2"	237
6"	250
12"	250
S.E.	± 25

Yields were so low that any differences would have been of academic interest only.

SUNFLOWER (PROJECT 714)

A spacing cum Manurial experiment on Sunflower for silage was carried out at Daudawa. Spacings were 1', 1½' and 3' on 3' ridges. Manurial rates were 0, 3 and 6 tons F.Y.M./acre. Yields in lb. green matter/acre were as follows :—

Manures	X	Spacing	Not sig.
0	5,714	1'	7,084
3	6,914	1½'	6,720
6	7,591	3	6,416
S.E.	± 494		± 494
Sig. diff. 5 per cent	1,412		—

Increased rates of application of F.Y.M. increased yields but only the difference between the 0 and 6 ton treatments was significant.

Closer spacing gave increased yields but not significantly so. The precision of the experiment was poor.

ROTATIONS (PROJECT 722)

Experiments on Rotations were carried out at Samaru, Yandev and Bida.

(1) *Effects of Monocropping*.—Interesting results are beginning to appear unexpectedly early in two trials (one at Samaru and one at Bida) comparing yields under a system of continuous monocropping with those under continuous rotation. At each station a three course rotation is used (Cotton-Guineacorn-Groundnuts at Samaru, and Cassava-Guineacorn-Groundnuts at Bida) and each of these crops appears both in rotation and in monocropping. Each treatment moreover, appears at four levels of manuring : 0, 1, 3 and 5 tons per acre per year of F.Y.M. Both trials started in 1949, but the 1949 yields are ignored, as in that year there could clearly be no monocropping vs. rotation effect. The following figures show the results of the three-year cycle 1950-52 :—

Mean of all Manurial rates—lb. per acre per year

	Mono-cropped	Rotation cropped	Difference
Cotton, Samaru (seed-cotton)	420	444	24
Guineacorn, Samaru (dry grain)	939	1,196	257**
Groundnuts, Samaru (decorticated) ..	717	1,035	318***
Total (three years), Samaru	2,076	2,675	599***
Cassava, Bida (tubers)	4,544	5,405	861*
Guineacorn, Bida (dry grain)	315	624	309**
Groundnuts, Bida (decorticated) ..	272	346	74
Total (three years) Bida	5,131	6,375	1,244**

Yields of guineacorn were reduced at both stations by monocropping, by 257 lb. per acre per year at Samaru, and by 309 lb. at Bida. Groundnuts suffered to the extent of 318 lb. at Samaru, but no effect has yet been detected at Bida. Cassava averaged 861 lb. per acre per year less when monocropped than when rotated.

Cotton at Samaru showed no overall effect, but an interesting significant interaction between monocropping and manurial rate emerged, which is illustrated in the following table:—

	<i>Mono</i>	<i>Rotation</i>	<i>Difference</i>
No Manure	184	314	+130
1 ton/acre	235	444	+209
3 ton/acre	610	498	—112
5 ton/acre	653	522	—131
Mean	420	444	+24

At low rates of manuring, rotation gave significantly higher yields, but at the two higher rates, the response was in favour of monocropping. This cannot at present be satisfactorily explained without further confirmation, but a possible suggestion is that at the high rates, the fertility of the rotation plots is too high for good seed cotton yields, while on the monocropped plots, monocropping has reduced fertility so as to overcome this. We have previously had experience at Samaru of heavy organic manuring producing very heavy vegetative growth of cotton, but poor yields of seed cotton.

In all other cases, there was no interaction between monocropping and manurial rates and the mean responses were as follows:—

	F.Y.M. :	0	1	3	5 tons/ac./Year.
Cotton, Samaru		249	339	554	587
Guineacorn, Samaru		571	770	1,337	1,592
Groundnuts, Samaru		542	801	1,030	1,131
Total (3 years) Samaru		1,362	1,910	2,921	3,310
Cassava Bida		2,360	3,925	6,857	6,755
Guineacorn, Bida		199	343	631	705
Groundnuts, Bida		333	286	284	331
Total (3 years) Bida		2,894	4,554	7,772	7,791

These figures are expressed as response per ton in the following table:—

	<i>First ton</i>	<i>Response per ton to second and third tons</i>	<i>Fourth and fifth tons</i>
Cotton, Samaru	90	107	16
Guineacorn, Samaru	199	283	127
Groundnuts, Samaru	259	114	50
Cassava, Bida	1,565	1,466	51
Guineacorn, Bida	144	144	37
Groundnuts, Bida	—	No responses	—

For groundnuts, no dressing above one ton per year has been worth while, but in all other cases (except perhaps Cassava) dressings up to three tons per year have been worth while: in no case has it paid to apply larger annual dressings than this.

General surprise has been expressed at the rapidity with which the deleterious effects of monocropping have become apparent: it was anticipated that differences of the magnitude observed would not appear for five or six years at least, particularly in the case of groundnuts.

(2) *Optimum Use of F.Y.M. in a Rotation.*—This experiment at Samaru is designed to discover whether at different rates of manuring it is better to apply all the manure to the grain crop or to give part to the cash crops.

The Rotation is Cotton, Guineacorn, Groundnuts. Manurial rates are a total of 3 v. 6 tons F.Y.M. during the three years of the rotation.

Methods of application are (a) all to guineacorn (b) $\frac{1}{2}$ to guineacorn and $\frac{1}{2}$ to cotton (c) $\frac{1}{3}$ to each crop.

The experiment has now completed three years and the first results are to hand. Yields are as follows in lb. threshed seed or seed cotton per acre per year.

	Cotton	Guineacorn	Groundnuts
Rate of Manure	xxx	xx	xxx
3 tons F.Y.M. over three years ..	453	1,051	974
6 tons F.Y.M. over three years ..	552	1,273	1,163
S.E. $\pm$	19	61	22
Methods of Application	xxx	Not Sig.	x
All to Guineacorn	439	1,274	1,052
$\frac{1}{2}$ to Corn, $\frac{1}{2}$ to Cotton	548	1,160	1,023
$\frac{1}{3}$ to each Crop	522	1,057	1,133
S.E. $\pm$	23	75	28
Sig. diff. 5 per cent	66	—	78
Sig. diff. 1 per cent	89	—	—
Sig. diff. 0.1 per cent	108	—	—

Interactions.—In none of the crops was the interaction between Rates and Methods of application significant.

The yields show that the area was in a good state of fertility to begin with and so the effects of methods of application might expect to be blanketed. And so it is noteworthy that Guineacorn, the crop which is normally manured, responds least to methods of application; cotton, the most valuable, responds most to a share of the manure and groundnuts, the second most valuable, takes second place in its response to a share of manure. As might be expected all crops in the 6 tons F.Y.M. rotation are significantly better than those in the 3 tons rotation.

The following table shows the gains (+) and losses (—) of the different crops in response to different methods of application. The rotation in which all the manure is applied to guineacorn is taken as standard.

C=Cotton
G=Guineacorn
P=Groundnuts

	3 tons F.Y.M.			6 tons F.Y.M.			Average		
	C	G	P	C	G	P	C	G	P
All to G ..	379	1,128	924	499	1,420	1,175	439	1,274	1,049
$\frac{1}{2}$ to G, $\frac{1}{2}$ to C ..	+139	—69	+16	+78	—158	—74	+109	—114	+28
$\frac{1}{3}$, $\frac{1}{3}$, $\frac{1}{3}$..	+85	—157	+130	+81	—278	+32	+83	—217	+81

(3) *Extension of cropping period in Rotation with Fallow.*—At Yandev the standard rotation is a three-year gamba fallow followed by a three-year cropping of yams, grain, benniseed. (Grain consists of guineacorn interplanted with millet and grain yields are the combined yields of the two). It is desired to see whether the cropping period can be extended to four years by applying artificial fertiliser either to a second year of yams or to a first year of grain hoping that a second year of grain will profit sufficiently from residual values to be successful.

The artificial fertiliser consists of 150 lb. Sulphate of Ammonia and 150 lb. Superphosphate per acre. The experiment is really in two parts in which the treatments are as follows:—

Year					Control	Treatment	Control	Treatment
1951	..	..	..	..	Yams	Yams	Yams	Yams
1952	..	..	..	..	Yams	Yams + F	Grain	Grain + F
1953	..	..	..	..	Grain	Grain	Grain	Grain
1954	..	..	..	..	Benniseed	Benniseed	Benniseed	Benniseed

Results to date are only intermediate but it is encouraging that yams with fertilisers yielded 8,395 lb. per acre as against 6,766 lb. for second year yams without fertilisers. The superiority was significant at 1 per cent. Both yields were much better than the 1951 first year yam yields of 4,958 lb. per acre.

Grain with fertiliser was significantly better than grain without fertiliser at 0.1 per cent. Yields were 1,332 as against 666 lb. threshed grain per acre. But in this case it is the 1953 yields which will be important.

(4) *Rates of F.Y.M. in Continuous Cropping.*—At Yandev an experiment was conducted from 1940 to 1951 to find the optimum rate of F.Y.M. applied to the grain crop in a three course rotation of yams, guineacorn interplanted with millet, benniseed. The manurial rates were 1 v. 2 v. 3 tons F.Y.M. per acre. It appeared after the 1951 season that 1 ton was gradually decreasing in fertility, 2 tons was holding its own and 3 tons was gradually improving. It was decided that more information regarding maintenance of fertility could be now obtained by changing the treatments as follows:—

Control Increase 1 ton to $1\frac{1}{2}$ tons F.Y.M./acre.

A .. Increase 2 tons to 3 tons F.Y.M./acre.

B .. Reduce 3 tons to 0 ton F.Y.M./acre.

Yields were as follows in lb. total threshed grain per acre:—

Control 728

A .. 938

B .. 870

None of the differences was significant but in any case no conclusions could be drawn at this early stage.

FALLOWS (PROJECT 723)

Fallowing experiments by their nature are, in some types, frequently not in the cropping stage. In addition many fallowing experiments in this Region are of recent origin and have not yet reached the stage at which conclusions can begin to be drawn. In consequence no 1952 data for analysis are available for eleven such experiments carried out at Bauchi, Daura, Bida, Maigana, Riyom, Samaru, Yola and Yandev. The experiments available for current analysis follow.

(1) Riyom. Legume Fallows.

Fallow period three years.

Fallow Crops six species of legumes, some indigenous and some introduced v. natural regeneration.

The test crop in 1951 was Dauro and in 1952 Acha. Yields in lb. threshed grain/acre were as follows :—

				1952	1951
<i>Test Crop</i>				<i>Acha</i>	<i>Dauro</i>
<i>Fallow Crop</i>				Not Sig.	Not Sig.
Tephrosia vogelii	..	..	..	732	464
Pigeon pea (Pusa 51)	..	..	..	728	500
Centrosema pubescens	..	..	..	732	504
Pueraria phaseoloides	..	..	..	816	556
Crotalaria sphactabilis	..	..	..	824	516
Mucuna (jubilack)	..	..	..	760	464
Natural Regeneration	..	..	..	824	480
S.E. $\pm$	..	..	..	40	41

All the sown treatments, in spite of annual supplying, were swamped by tall grass and, in effect, were little different from natural regeneration. Under these circumstances it is not surprising that no significant differences occurred.

(2) *Yandev. Pigeon pea v. Gamba Fallows.*—The rotation here is four and a half years fallow followed by Yams, Grain, Benniseed. In the first cropping cycle (1945-47) there were no significant differences between the treatments but the crops following Gamba were the better. In 1952, the first year of the second cropping cycle, yields of yams in lb. tubers/acre were as follows :—

Average yield eight plots after pigeon pea..	..	..	..	13,013
Average increase seven plots after Gamba..	..	..	..	+205
S.E. $\pm$ 365.	Odds 3:1.			

The effects of the two types of fallow appear to be almost the same.

(3) *Yandev. Continuous cropping with F.Y.M. v. Fallows.*—To compare continuous cropping with 3 tons F.Y.M. applied only to yams in rotation of yams, grain, benniseed, with different types of three-year fallow. In 1952, the first year of the third cropping cycle yields of yams in lb. tubers/acre were as follows :—

<i>Treatments</i>				<i>Not Sig.</i>
(1) Natural Regeneration	..	..	..	11,507
(2) Gamba Untreated	..	..	..	11,715
(3) Gamba cut yearly in May and left..	..	..	..	11,865
(4) Gamba cut, composted and compost returned	..	..	..	11,512
(5) Pigeon peas	..	..	..	12,659
(6) F.Y.M. 3 tons/acre to Yams	..	..	..	10,206
S.E. ...	..	..	..	$\pm$ 666

Treatments are not significantly different. In the previous cropping cycle the only significant difference was in the grain crop when yields after treatment (3) were significantly better than the others at 5 per cent.

(4) *Woody Shrubs as Fallow Crops.*—At Yandev investigations were started in 1941 on the possibility of establishing wild woody shrubs to produce an improved fallow. The species chosen were *Lophira alata* and *Azelia africana* which were interplanted. Two spacings were used, 6' $\times$ 6' and 6' $\times$ 12', the intervening gaps being allowed to regenerate naturally. The control fallow was gamba. Unfortunately, very poor establishment of these species was achieved even after several years of supplying and test crops gave no reliable indications.

Yields in the 1950-52 cropping cycles were as follows in lb. tubers and threshed seed per acre :—

	<i>Yams</i>	<i>Grain</i>	<i>Benniseed</i>
Average yield ten gamba plots	13,466	1,229	354
Average diff. five plots shrubs 12'×6'	—118	+17	—53
Average diff. four plots shrubs 6'×6'	—859	—223	—144

No reliable conclusions may be drawn at present.

(5) *Yandev Pigeon pea v. Gamba Fallows*.—Here again the rotation is four and a half years fallow followed by yams, grain and benniseed. In the first cropping cycle (1944-46) there were no significant differences between the treatments, but the response to Gamba Fallow was better. In the second cropping cycle, the results obtained on yams in 1951 and on grains in 1952 showed that pigeon pea was better than gamba; differences, however, were not significant.

Yields in lb. per acre were :—

	1951 (<i>Yams</i>)	1952 (<i>Grains</i>)
Average yield of nine pigeon pea plots ..	8,455	1,243
Average decrease of eight gamba plots ..	—1,160±613	—54±68
Odds	34:1	3:1

The experiment is now discontinued. The main findings being that the treatments, although not significantly different between themselves have raised the fertility higher than it was in the last pre-fallow year.

ORGANIC MANURES (PROJECT 724)

To compare Farm Yard Manure made underfoot (inside pen) throughout the year with compost made from the litter removed fortnightly from Mid-May to end of September plus the F.Y.M. made underfoot during the remaining period of the year.

Five head of cattle in each case were used in producing the manure which was applied only to grain crops in a rotation of yams, grains and benniseed, and the trial was sited at Yandev.

The following are the results to-date :—

YIELDS IN LB. PER ACRE

<i>Years and Crops</i>	<i>Compost at 4.23 ton/acre</i>	<i>F. Y. M. at 3.23 ton/acre</i>	<i>Differences</i>
1944 Millet and Guineacorn	2,486	2,493	7
1945 Benniseed	306	304	2
1946 Yams	2,490	2,374	116
1947 Millet and Guineacorn	2,152	1,825	327*
1948 Benniseed	272	248	24
1949 Yams	—	—	—
1950 Millet and Guineacorn	1,851	1,720	131
1951 Benniseed	482	461	21
1952 Yams	7,902	7,152	750

The indication is that compost may give a better yield than F.Y.M., but this increase is not worth the extra labour involved in making the compost.

III.—BOTANY SECTION

By A. R. MAURER

Organisation.—The Botany section has handed over its agronomic trials to the Agronomy Section, its Grass and Legume work to the Pasture Section, and the Meteorological observations for which it was previously responsible to the Cotton Entomologist. The section is now responsible for the following work at Samaru and on outstations in the North :—

- (a) All variety trials on all crops except Cotton.
- (b) Plant Breeding and Selection on the major and minor crops except cotton and maize.
- (c) Citrus, and other fruits at Samaru.
- (d) Horticulture at Samaru.
- (e) All plant introductions for the North, in co-operation with the Research Adviser and the Plant Quarantine Officer, Ibadan.
- (f) Multiplication and maintenance of pure strains for supply to outstations.
- (g) The G79 rice multiplication scheme.
- (h) Liaison for Pathological and Entomological work between stations in the North and Specialists in Ibadan.
- (i) Records on "Farm Gardens" at all outstations.
- (j) Photography at N.R.S.

A.—WORK AT SAMARU

THE 1952 SEASON

Millet was sown between the 10th and 12th of May, while climatic conditions were suitable. This planting made good progress and survived the drought at the end of May and early June. Guineacorn was planted between the 29th May and 28th June. Maize was planted on 28th and 29th May and suffered considerably from lack of moisture. Groundnuts were planted between June 22 and July 3. Cassava was harvested late, between 26th June and 5th July.

During the early part of the growing season an acute labour shortage occurred and some of the crops suffered from excessive competition from weeds.

The late planting followed by heavy rains and flooding in July and August and combined with an early cessation of the rains, resulted in lower-than-average yields.

PERMANENT ROTATION PLOTS

This project was initiated in 1948. It consists of a straight rotation of Cotton, Guineacorn and Groundnuts, with an application of 3 tons per acre F.Y.M. on the Guineacorn course.

The object is to record over a long period of years the yields and general growth characters of the three crops and eventually to correlate these factors with climatic variations from year to year.

The following table compares date of planting and yields since 1948 :—

TABLE II

		1948		1949		1950		1951		1952	
		Planting Date	Yield	Planting Date	Yield	Planting Date	Yield	Planting Date	Yield	Planting Date	Yield
Cotton	.. ..	2-7-48	449	6-7-49	305	3-7-50	472	5-7-51	431	3-7-52	175
Guineacorn	.. ..	28-5-48	1,665	28-5-49	1,424	25-5-50	1,355	6-6-51	1,243	6-6-52	743
Groundnuts	.. ..	25-6-48	1,209	24-6-49	1,200	23-6-50	1,209	22-6-51	666	13-6-52	937

Where : Cotton is shown as lb. seed cotton per acre.

Guineacorn is shown as lb. dry threshed grain per acre.

Groundnut is shown as lb. shelled nuts per acre.

PESTS AND DISEASES

(a) *Samaru*.—At Samaru there was no indication that any pests or diseases were increasing. The usual damage from stem borers, smut and striga were recorded on guineacorn ; maize suffered to a slight degree from rust ; groundnuts were affected by Rosette and leaf spot. In no case was damage heavy and yields would not appear to have been affected.

MILLET—(PENNISETUM TYPHOIDEUM)

In 1951, fifty-one strains of early maturing millet were selected and selfed. These strains were planted in 1952 and a total of 328 further selections were made.

It is hoped to cross the best of these strains in 1953 to produce hybrid varieties. It is hoped that several varieties maturing in less than seventy-six days will be produced.

A collection of millet varieties from other stations in the North was established at the suggestion of Professor Webster (E.C.A. Agronomist) but a breeding programme utilising these strains cannot be initiated at the present due to the staff situation.

GUINEACORN—(SORGHUM VULGARE)

(a) *Dr Webster's Programme*.—The programme initiated by Dr Webster has been carried on at Samaru and on several stations, as well as staff conditions would allow. Four statistical experiments were conducted and results of these are included in this report. The collection of imported sorghums was maintained and plant characteristics of each variety were recorded. The breeding programme was also continued and successful crosses between Nigerian and American varieties were made.

(b) *Variety Yield Trial—A14 (52)*.—This experiment was designed to compare yields of four Nigerian varieties of Guinea-corn, Tall Kaura, Short Kaura, Farafara and Light Mori under Samaru conditions. Although the results were statistically insignificant, Tall Kaura gave the highest yield. Yields were as follows (lb./acre grain) :—

Variety	Yield 1951	Yield 1952
Tall Kaura	1,262 (a)	1,997
Short Kaura	2,108	1,739
Light Mori	2,466	1,642
Farafara	2,141	1,625
S.E.	±106	±103

(a) Tall Kaura headed about two weeks earlier than the other varieties in 1951, and suffered very heavy bird damage as a consequence.

(c) *Farafara (Mass Selection) Yield Trial—A15 (52)*.—This trial was initiated in 1949 to investigate the efficiency of normal mass selection as a means of maintaining or improving an unselected variety, and to compare normal mass selection with possible modifications of it in order to determine a satisfactory method of maintaining or improving a variety on a Provincial farm without recourse to complex plant breeding methods. The modifications included selfing heads at various stages, and one year progeny tests before a selection entered the mass for multiplication.

The selection methods and 1951 and 1952 yields were as follows :—

	Yields lb/ac. grain	
	1951	1952
1. Control : unselected—a small plot planted and re-established annually from unselected seed	2,135	1,658
2. Normal Mass Selection : maintenance by annual selection of 100 good heads selected for size and type	2,495	1,651
3. Bulk open pollinated high yielding selections : heads selected as in 2 grown as replicated progeny rows for one year, the 8 highest yielders then bulked and subsequently multiplied without further selection	2,365	1,674

4. Bulk open pollinated medium selections : ditto, but 8 medium yielders bulked	2,058	1,530
5. Bulk open pollinated worst selection : ditto, but 8 worst yielders bulked	1,840	1,616
6. Bulk selfed seed from high yielding selections : same selections as method 3, but seed bulked from heads selfed in the progeny rows instead of open pollinated	2,055	1,578
7. High yielding open pollinated progeny from selfed seed : as method 3, except that original selections were made from selfed heads instead of open pollinated	2,133	1,649
8. Selfed seed from the 8 highest yielding rows planted from selfed plants	2,148	1,537
S.E.	±127	±109

The ideas behind these modifications were as follows : method 2 against method 1 tests the value of mass selection compared with no selection. Method 3 tests the value of progeny testing the initial selections before accepting them for multiplication. Comparisons of 3, 4, and 5 show whether performance in the progeny rows is a reliable criterion, and differences carried forward through subsequent multiplications. The remaining methods are aimed at preventing dilution of good selections by cross pollination from undesirable sources during the stages when they may be cheek-by-jowl with such sources—method 6 avoids dilution in the progeny row stages, 7 in the original selection stage and 8 in both these stages.

Results are inconclusive, but the trial shows no signs that there is any need to worry about these dilution possibilities. The 1951 yields appeared to show that the best progeny rows maintained their superiority to the medium and poor rows, and that therefore the progeny testing stage should be worth while, but the differences did not persist in 1952. Moreover, the best progenies were not better than non-progeny-tested mass selections (a result which agrees with findings over several years at Gusau). Mass selection appeared in 1951 to be better than no selection, but the difference did not carry through to 1952, in which year no significant differences appeared.

It is possible that these conflicting results were due to the fact that the variety used was one which had been mass-selected at Samaru over a number of years, possibly from a small initial population, and the inherent variability may have been too small at the start (this also applies at Gusau). Methods 1 to 5 would be worth further trial on a really unselected variety purchased in a local village.

(d) *Striga* Investigation. Experiment A16 (52).—This experiment (which originated similarly to the Bauchi trial reported by the Agronomist on page 6) was designed to determine whether crops, other than sorghum, could stimulate the germination of *Striga senegalensis* in the soil and thereby reduce the potential population of this parasite. The experiment was sited on a block of land in which the *Striga* population has been deliberately built up over several years.

In 1951 plots were planted with Guinea-corn, Groundnuts, Sunflower and Cowpeas. The *Striga* which grew in the Guinea-corn plots was eradicated by hand. Groundnuts were included as a control, because long experience has shown that a course of this crop between grain courses does not control the parasite.

In 1952 a test crop of Farafara guinea-corn was planted on all plots. *Striga* counts were taken and yields recorded at the end of the season. Groundnuts had no effect as expected, and cowpeas were ineffective as well. The 1951 Guinea-corn plots on which *striga* had been eradicated produced the least number of *striga* plants in 1952 and the sunflower plots gave the highest count.

Although it may be too early to come to any conclusions it would appear that the non-host species tested do not stimulate the germination of *Striga senegalensis*, under Samaru conditions.

Striga counts and yields of grain were as follows (yields have, of course, no bearing on the point under investigation, but give some indication of (a) the value of cowpea as a preceding crop to Guinea-corn and (b) the deleterious effect of monocropping with guinea-corn).

	<i>Striga count</i>				<i>Grain yield</i>
	<i>plants/acre</i>				<i>lb/acre</i>
1. After guinea-corn in 1951	..	..	..	6,720	540
2. After sunflower in 1951	..	..	..	16,620	930
3. After cowpeas in 1951	..	..	..	14,640	960
4. After groundnuts in 1951	..	..	..	16,440	810
S.E.	..	..	..	±2,250	±45

Eradication in 1951 appears to have been very effective in reducing the striga population.

(e) *American Sorghum Variety Yield Trial—A17 (52).*—This has been the first yield trial conducted with the American sorghum varieties introduced by Dr Webster. Those varieties which were judged best in the 1951 observation plots were incorporated.

Of the 13 varieties grown, the highest yields were obtained from Hegari, Ladore and Pink Kafir.

Palatability tests conducted with these varieties showed that Hegari was most acceptable to the Hausa taste. It would appear that it is similar in flavour and "body" to the Farafara commonly used. Seven other varieties were considered "acceptable" and the remainder were disliked.

Yields were :—

<i>Variety</i>	<i>lb/ac. grain</i>	<i>Grain Quality</i>	<i>Palatability</i>
Hegari	1,733	Good	Wholly acceptable.
Ladore	1,533	Good	Acceptable.
Pink Kafir	1,077	Good	Acceptable.
Martin	930	Good	Acceptable.
Sedan Red	817	Good	Acceptable.
Dwarf Shallu 5770-49-18	737	Mouldy	Not acceptable.
Redland	705	Good	Acceptable.
Gurno	679	Weathered	Slightly off flavour.
Shallu 5651-12	626	Mouldy	Not acceptable.
Midland	624	Good	Acceptable.
Redbine 66	617	Good	Acceptable.
Dwarf Kafir 44-14	475	Weathered	Slightly off flavour.
Combine 6C	254	Weathered	Slightly off flavour.
S.E.	±105		

The majority of these varieties matured at the end of August and beginning of September during the wet season. Harvesting therefore had to be done under unfavourable condition.

It was necessary to hang harvested heads on strings under cover in a drying shed. Even then, some of the varieties which had become mouldy in the field, did not produce a clean product.

The palatability test was conducted with Hausa labourers. It should be noted that in every case where the grain was "unacceptable" or "off flavour", the material offered for test was weathered or mouldy.

One advantage of the American sorghums' short height, is the ease of harvesting. They can be easily handled by cutting off the heads with a sickle while local guinea-corn must be cut down at the base of the plant before heads can be reaped.

Some of these varieties can give good yields, as is shown above, and could find a place in local agriculture if the farmers are prepared to dry them. In the Middle Belt, farmers are accustomed to drying or smoking their millet under shelter and it would be no innovation to them to carry out the same procedure on sorghums.

Two other possibilities should be taken into consideration. The first is that these early strains may be able to mature in the "short dry" season further South. The other is that they may be suitable for far Northern conditions in the millet belt where there is an early cessation of rains.

MAIZE (*ZEA MAYS*)

Results from trials at Samaru and stations in the North are sent to the Botanist, Ibadan, whose responsibility it is to report them.

RICE (*ORYZA SATIVA*)

(a) *Maintenance and introduction of Varieties.*—Due to serious losses of new varieties sent to stations in the North in the past, it was decided that the Botanist should maintain all existing varieties at Samaru. All new introductions have been kept here for maintenance and small scale multiplication. Due to the very limited space available at the Samaru Dam Site, the size of plots had to be drastically reduced to accommodate the over 100 varieties on hand. A large number of new introductions have been received for planting in 1953 and efforts will be made to increase the area at the dam.

It is hoped that all this work will be taken over by the Rice Research Station at an early date.

(b) *Multiplication.*—The Botanist is responsible for the production of "Pure" seeds for the multiplication scheme involving G79 rice variety. This multiplication scheme is discussed on page 40.

BENNISEED (*SESAMUM INDICUM*)

(a) *Selection Work.*—Selection work on Benniseed is conducted by the Botanist and his staff and the crop is grown at Yandev. All weighing and other laboratory procedures are done at Samaru while cultural operations are under the care of Agricultural Officer, Yandev. This work is discussed on page 37.

(b) *Introductions.*—A number of varieties were received late in the season from the United States of America. These were grown under adverse conditions at Samaru and some seeds were collected. A few varieties did not adapt themselves to our climatic conditions and may be of no value. Seed of a "non-shattering" type was received and it is hoped that this may be of value in future breeding work. Seed of all these varieties was sent to Yandev for late planting in 1952.

GROUNDNUTS (*ARACHIS HYPOGEA*)

(a) *Selection Work at Samaru.*—The selection programme has been continued and high yielding strains were collected from different populations. This old programme had its chief weakness in the "reselection" from previously discarded strains and indications are that none of the strains chosen in 1952 are as good as the earlier ones.

A new collection of possibly heavy yielding strains has been obtained from outstations in the groundnut growing belt and these plants will form the nucleus of a new selection programme in 1953.

(b) *Hybridization.*—The work continues but is held back by the lack of facilities. Seeds of all crosses made to date will be sown in 1953 for multiplication and observation.

(c) *Introductions.*—Seeds have been received from different parts of Africa and Indonesia. Word has been received that a shipment is underway from the United States of America. These seeds have been sent by members of the O.E.E.C. Mission and it is hoped that the varieties will be suitable to Northern Nigerian conditions.

(d) *Groundnut Variety Yield Trial A1 (52).*—This experiment compares the performance of fifteen varieties of groundnuts and is designed to determine the seasonal variations of certain strains under Samaru conditions. The table on page 22 shows this year's results and those of

former trials. Yields were much poorer than usual. It would appear that certain strains, such as M.L. 372, are extremely variable in their response to climatic conditions, their performance fluctuating greatly year by year. Others such as M.J. 371 and Castle Cary are maintaining a fairly steady position near the top of the list but do not come out in first place position very often. Samaru thirty-eight follows almost consistently behind Castle Cary and is only occasionally better. Natal Common has fallen to a low position after a spectacular start in 1949. This variety will not be included in the 1953 trial. Samaru thirty-eight *ex*-Kontagora was included in the 1950 to 1952 trials as it was suspected that it was not true Samaru thirty-eight. Although last on the list of average, it has performed relatively well to date.

GROUNDNUT VARIETY TRIALS—SAMARU 1945-52

Columns 2 to 9 show the relative positions of the varieties in the year named

No. of Varieties	Year: 1945 49	1946 25	1947 25	1948 12	1949 15	1950 15	1951 15	1952 15	1952 Unshelled Nuts	1952 Shelled Nuts	1946*-52 Average in lb. per acre Shelled Nuts
M.J. 371 ..	12	2	10	6	3	2	5	1	1,068	669	897
M.K. 383 ..	8	15	2	7	2	1	2	9	960	567	894
M.J. 374 ..	1	1	7	2	4	3	13	2	1,019	634	841
Castle Cary ..	48	10	6	1	6	4	9	12	1,039	558	839
Samaru 38 ..	45	11	5	4	12	5	6	7	1,068	597	837
Kano 38 ..	—	6	1	9	7	7	10	4	1,080	621	827
M.G. 371 ..	6	4	20	5	10	11	4	11	1,000	562	821
Kano 50 ..	—	—	—	—	—	9	3	5	1,056	616	820
M.L. 378 ..	2	8	17	7	8	6	8	6	1,003	613	814
M.K. 374 ..	8	5	3	11	5	8	12	10	1,062	565	812
M.L. 3710 ..	4	12	19	3	13	13	11	13	981	542	804
M.L. 372 ..	3	12	15	12	11	15	1	14	956	530	803
M.L. 384 ..	5	16	4	10	9	10	14	3	1,022	629	791
Natal Common ..	—	—	—	—	1	14	15	15	952	435	751
S. 38 <i>ex</i> -Kontagora ..	—	—	—	—	—	12	7	8	1,080	581	722

*1945 Yields are not included here because of bad flooding that year.

S.E.

±37

(e) *Groundnut Variety Yield Trial II—A6 (52)*.—Fifteen varieties (including Castle Cary and Natal Common which were under trial in A1 (52)) were compared in a balanced lattice experiment.

Results show that none of the varieties tried were as high yielders as Castle Cary. The following table compares the 1952 results with those of 1951 :—

COMPARISON OF RESULTS OF A6 (51) AND A6 (52) IN LB. PER ACRE KERNELS

Variety	1951	1952	Average 1951-52
Castle Cary ..	1,436	778	1,107
Mache Atsugune ..	1,328	658	993
Dixie Runner ..	1,408	548	978
M'Putu A ..	1,314	575	945
Tudun Wada ..	1,288	598	943
Yipa ..	1,296	549	923
Toro ..	1,337	509	923
Valencia ..	1,262	569	914
M'Putu B ..	1,278	498	888
Castle Cary <i>ex</i> -Bida ..	1,138	562	850
Kono ..	1,156	520	838
Natal Common ..	1,114	527	821
M'Putu C ..	1,208	415	812
Spanish 205 ..	1,134	456	795
Phillipine White ..	716	548	632

Sig. diff. 5%

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(f) *Groundnut Reselection Yield Trial (A7 (52))*.—This experiment was designed to compare fourteen of our 1950 selections against Samaru thirty-eight as standard. It is a repeat of A7 (51).

The results are encouraging in that they show Samaru thirty-eight near the bottom of the yield figures. This is the third consecutive trial in which these selections have outyielded Samaru thirty-eight.

The following table compares the results of A7 (52) and A7 (51) :—

COMPARISON OF RESULTS OF A7 (51) AND A7 (52) SHOWN IN LB. PER ACRE, KERNELS

	1951	1952	Average
L 234	1,214	413	814
L 250	1,168	431	800
L 235	1,148	420	784
L 266	1,146	408	777
L 60	1,158	383	771
L 258	1,144	388	766
L 245	1,141	390	766
L 126	1,156	373	765
L 366	1,132	399	765
L 272	1,113	385	749
L 53	1,150	335	743
L 121	1,094	362	728
L 260	1,138	310	724
L 200	1,024	381	703
Samaru 38	1,056	331	694

(g) *Pure Lines vs. Mixtures Yield Trial—A2 (52).*—A series of experiments was started in 1949 to test the hypothesis that mixing of a number of strains in predetermined proportions may give a higher average as being less susceptible to seasonal climatic variations.

The following tables compare results from 1949 to 1952 :—

UNSHELLED NUTS YIELDS/ACRE

Treatments	1949	1950	1951	1952	Totals	Avs.	Positions
(6) S. 38	1,890	1,612	1,191	784	5,477	1,369	1st
(3) 50% S. 38, 50% MJ. 374 ..	1,964	1,589	1,087	756	5,396	1,349	3rd
(5) 25% S. 38, C.C., MJ. 374, ML. 3710	1,827	1,480	1,049	800	5,156	1,289	5th
(7) 50% S. 38, 50% ML. 3710 ..	1,850	1,346	974	700	4,870	1,217	9th
(8) Castle Cary	1,798	1,471	1,219	750	5,238	1,309	4th
(2) 75% MJ. 374, 25% C. Cary	1,700	1,414	1,071	710	4,895	1,224	7th
(4) ML. 3710	1,664	1,428	1,112	680	4,884	1,221	8th
(9) 50% S. 38, 50% C. Cary ..	1,813	1,544	1,214	823	5,403	1,351	2nd
(1) MJ. 374	1,693	1,441	1,057	824	5,015	1,254	6th

KERNELS YIELDS/ACRE

Treatments	1949	1950	1951	1952	Totals	Avs.	Positions
(6) S. 38	—	1,122	822	371	2,315	772	1st
(3) 50% S. 38, 50% MJ. 374 ..	—	1,100	757	333	2,190	730	3rd
(5) 25% S. 38, C.C., MJ. 374, ML. 3710	—	1,047	737	323	2,107	702	5th
(7) 50% S. 38, 50% ML. 3710 ..	—	939	680	322	1,941	647	9th
(8) Castle Cary	—	1,003	829	321	2,153	718	4th
(2) 75% MJ. 374, 25% C. Cary	—	994	750	320	2,064	688	6th
(4) ML. 3710	—	980	765	320	2,065	688	6th
(9) 50% S. 38, 50% C. Cary ..	—	1,075	845	301	2,221	740	2nd
(1) MJ. 374	—	973	729	269	1,971	657	8th

Over the four years, Samaru thirty-eight has given the best average yield, and has been the highest yielder of the year once. A mixture of 50 per cent each of Castle Cary and Samaru thirty-eight has given the second best average. The trial will continue, but there is no indication so far that any of the mixtures tried is any more reliable from year to year than the best of the pure lines.

(h) *Groundnut Close Spacing Trial*—A5 (52).—This trial is the final one of a series designed to confirm results obtained at Daura and Kafinsoli, that higher yields of groundnuts can be obtained with closer spacing than that normally adopted in Nigeria. The trials were started in 1950.

The following treatments were incorporated in these trials :—

1. 9" on 3' ridges	}	Approximately equivalent to present plant population i.e., 324 square inches per plant.
2. 11" on 2'6" ridges		
3. 13½" on 2' ridges		
4. 4½" on 3' ridges	}	Approximately equal to twice present plant population, i.e., 162 square inches.
5. 5½" on 2½' ridges		
6. 6½" on 2' ridges		
7. 6½" on 3' ridges	}	Approximately equal to 1½ times present plant population, i.e., 243 square inches.
8. 8" on 2½' ridges		
9. 10" on 2' ridges		

The yields over the three years have been as follows (undecorticated, lb. per acre):—

Ridge width	1950				1951			
	3'	2½'	2'	Mean	3'	2½'	2'	Mean
Close spacing	1,628	1,624	1,733	1,662	1,518	1,614	1,746	1,626
Medium „	1,594	1,550	1,794	1,646	1,692	1,634	1,840	1,722
Wide „	1,453	1,634	1,607	1,565	1,706	1,720	1,732	1,719
Mean	1,558	1,603	1,711	1,624	1,639	1,656	1,773	1,689

Ridge width	1952				MEAN 1950-52			
	3'	2½'	2'	Mean	3'	2½'	2'	Mean
Close Spacing	701	803	787	764	1,282	1,347	1,422	1,350
Medium „	769	798	747	771	1,352	1,327	1,460	1,380
Wide „	654	707	842	734	1,271	1,354	1,394	1,340
Mean	708	769	792	756	1,302	1,343	1,425	1,356

The overall indications each year have been in favour of the narrowest ridge (2'). For spacings on the ridge, differences overall are not significant, but in each year the mean of the medium spacing (243 square inches per plant) has come out highest.

(i) *Groundnut Seed Dressing Trial*—A3 (52).—This trial is a continuation of a series begun in 1948 to test the effect of seed-dressings on germination and yields of groundnuts.

The 1948 trial (A5 (48)) consisted of two compounds applied at two rates and planted at one and two seeds per hole.

The compounds used were :

A. Agrosan GN-PP 1551-R4. (This is a mercurial compound containing 1 per cent of organically combined mercury).

B. R1104X49 (An experimental non-mercurial dressing containing 50 per cent tetramethylthiuramdisulphide).

In 1950 the trial was conducted with compound B only and the same rates of application were used. Yields are shown below :—

<i>Treatment</i>	1950
1. No dressing 1 seed/hole	1,398 (6)
2. No dressing 2 seeds/hole	1,473 (3)
3. B at 2 ozs/100 seeds 1 seed/hole	1,400 (5)
4. B at 2 ozs/100 seeds 2 seeds/hole	1,491 (2)
5. B at 4 ozs/100 seeds 1 seed/hole	1,449 (4)
6. B at 4 ozs/100 seeds 2 seeds/hole	1,647 (1)

In 1951 and 1952 a third compound, commercial "Fernasan", was used as well as compounds A and B. The rates of application were similar, i.e., 2 and 4 ozs. of dressing per 100 lb of seed.

Groundnut yield in 1952 were not significantly different. A comparison of the 1951 and 1952 results is shown below :—

SEED DRESSING TRIAL—YIELDS IN LB./ACRE UNDECORTICATED

<i>Treatment</i>	1951	1952	<i>Average</i>
12. 'C' at 2 ozs/100 lb. 2 seed/hole	1,768	672	1,220 (1)
8. 'B' „ 2 „ 2 „	1,734	669	1,202 (2)
6. 'A' „ 4 „ 2 „	1,741	661	1,201 (3)
7. 'B' „ 4 „ 1 „	1,765	637	1,201 (3)
4. 'A' „ 4 „ 2 „	1,748	630	1,189 (4)
13. 'C' „ 4 „ 1 „	1,706	637	1,172 (5)
10. 'B' „ 4 „ 2 „	1,607	733	1,170 (6)
3. 'A' „ 2 „ 1 „	1,685	629	1,157 (7)
11. 'C' „ 2 „ 1 „	1,706	595	1,151 (8)
14. 'C' „ 4 „ 2 „	1,674	624	1,149 (9)
5. 'A' „ 4 „ 1 „	1,681	584	1,133 (10)
1. No dressing „ 1 „	1,660	586	1,123 (11)
9. 'B' 4 ozs/100 lb. 1 „	1,672	539	1,106 (12)
2. No dressing „ 2 „	1,595	558	1,077 (13)

A point worth noting is that the treatments with no dressing appear near the bottom of the list. No recommendations can yet be made regarding type of seed dressing or rate of seeding on the basis of these figures as, unfortunately, vacancies were supplied.

Germination counts were taken showing the number of stands with 0, 1 and 2 plants. The following table shows the percentage number of stands containing no plants (before supplying) :—

PERCENTAGE VACANT STANDS IN 1951 AND 1952 TRIALS

		<i>None</i>	<i>A 2 oz.</i>	<i>A 4 oz.</i>	SEED DRESSING			
					<i>B 2 oz.</i>	<i>B 4 oz.</i>	<i>C 2 oz.</i>	<i>C 4 oz.</i>
<i>One Seed</i>								
1951	.. ..	20.6	13.9	11.4	18.6	22.7	20.7	18.0
1952	.. ..	37.6	13.0	13.7	47.9	17.8	20.5	14.8
<i>Two Seeds</i>								
1951	.. ..	1.3	9.4	3.8	5.0	8.5	1.8	8.0
1952	.. ..	22.9	24.5	18.0	5.1	4.0	6.1	15.2

Planting one seed per stand, the indication is that in both years compound A may have produced a real improvement in germination. There is no indication that the heavier rate of A is better than the lighter one. There is no indication in either year that Compound B has done any good (except perhaps at the heavier rate in 1952) and Compound C, while of no value in 1951, may have been of some use in 1952.

Using two seeds per stand, an almost complete establishment (of one or two plants per stand) was obtained in 1951 with no dressing at all, but a very poor one in 1952. As a consequence, the dressings could not show an improvement in 1951, while in 1952 their results are quite contradictory to the results from one seed per stand, B and C appearing effective and A not effective. The question clearly requires further investigation.

SOYA BEANS (GLYCINE MAX.)

(a) *Variety Yield Trial*—A9 (52).—This trial is a modified repeat of A10 (51). It was designed to determine whether certain varieties which had performed well in the Botanist's Stock Plots, would yield better than the varieties Malayan and Benares at present regarded as standard. Results in 1951 and 1952 appear to confirm this view. The 1952 differences are not statistically significant.

Yields obtained from 1949 to 1952 were as follows, and Bilomi No. 3 and No. 1 and Misc. 94 are clearly promising :—

SOYA BEAN VARIETY TRIALS (LB/AC. THRESHED BEANS)					
<i>Variety</i>	1949	1950	1951	1952	<i>Average</i>
Bilomi No. 3	—	—	1,148	1,174	1,161
Misc. 94	—	—	1,088	1,154	1,121
Bilomi No. 1	—	—	1,021	1,048	1,035
Malayan	1,032	—	—	1,038	1,035
28 E.B.	—	—	—	980	980
Black Matted Java	—	—	983	974	979
Yellow Bermeley	—	—	798	1,159	979
Benares	1,079	952	846	986	966
Avoyelles	1,102	811	—	—	957
Acadian	935	646	—	—	791
Mamloxi	719	604	—	—	662

(b) *Maintenance*.—A total of 18 varieties were maintained in the stock plots in 1952.

In 1953, no experimental programme is planned with soya beans at Samarú. This is necessary due to shortage of technical staff. All varieties will, however, be maintained in the stock plots.

SUNFLOWER (HELIANTHUS ANNUUS)

(a) *Variety Yield Trial*—A12 (52).—This experiment compared four introduced varieties with the common grey seeded strain. Significant results were obtained as shown below. Grey seeded was the heaviest yielder and Saturn is the best of the introduced varieties.

YIELDS IN LB/ACRE THRESHED SEED					
<i>Variety</i>	1950	1951	1952	<i>Average</i>	
Grey Seeded	983	1,147	1,033	1,054	
Saturn	1,049	846	909	935	
Hungarian	898	406	594	633	
Advanced Hybrid	—	330	506	418	
Sunrise	513	165	378	352	
Sig. diff. at 1.0 per cent	..	..	..	230	
Sig. diff. at 5.0 per cent	..	..	..	168	

It has been decided not to repeat this experiment in 1953. The varieties will be maintained in isolation, however.

(b) *Maintenance*.—It has been found necessary to grow sunflowers in isolation plots to maintain their purity. Selfing has been tried with baf cotton bags, using "clean bees" as pollinating agents. This has not been successful as most of the resultant seeds are empty. Considerable difficulty has been experienced in finding a sufficient number of isolation plots due to the concentrated area under cultivation at Samaru and the cropping schedules of other sections on the station.

SUGAR CANE—(SACCHARUM OFFICINALE)

Introductions of new varieties are being received from Ibadan. These are being multiplied as rapidly as possible. When sufficient material is available, canes will be planted at the Samaru Dam Site for the Pathologist's use.

Red Rot disease of sugar cane is discussed under "Pests and Diseases" (page 39).

TOBACCO—(NICOTIANA TABACUM)

The Nigerian Tobacco Company has again assisted us in conducting a tobacco variety trial. Experiment A13 (52) contained five new varieties from the N.T.C. and six selections of Virginia Hybrid from Gusau.

The excessive rains of July caused a great deal of waterlogging and the trial was not a success. Size of leaf was small but a greater quantity of leaves were harvested than had been expected. The tobacco is at present being cured and no final results are available. In 1953, a similar experiment will be planted on an upland field where it is hoped that waterlogging will be avoided.

CASSAVA—(MANIHOT UTILISSIMA, M. PALMATA)

(a) *Mosaic Resistance*.—The problem of finding varieties or strains of cassava which are truly tolerant to mosaic is still with us. In one of our trials, disease free Dan Warri developed severe signs of infection in 1952.

(b) *Cassava Yield Trial (Mosaic Effect)* A11 (51).—This experiment is part of a series of trials begun in 1949 to determine the effect of mosaic on yield. This year's results were statistically insignificant but the trend established in 1950-51 was maintained. The 1949-50 trial was a failure due to lack of planting material. Previous to 1949 a trial had been conducted using "Clean" Dan Warri from Samaru vs. Infected Dan Warri from Zonkwa, (A2 (48)). The results were significantly in favour of the clean Samaru Dan Warri but no conclusions could be drawn as the Zonkwa strain may not have been identical to that grown at Samaru. The 1949 trial was therefore designed to include Samaru Dan Warri multiplied up from plants which became infected during the 1948 trial.

The following table compares yields obtained in 1949, 1951 and 1952 (i.e., from the 1948, 1950 and 1951 trials).

		1949	1951	1952
Infected Dan Warri <i>ex</i> -Zonkwa	..	7,020	12,849	12,633
Clean Dan Warri <i>ex</i> -Samaru	..	10,390	11,873	12,300
Infected Dan Warri <i>ex</i> -Samaru	..	—	10,966	11,000
Sig. diff. 1 per cent	..	2,101	N.S.	N.S.

Yields are shown in lb. of tubers per acre.

Although no significant results were obtained in 1951 and 1952, there appears to be a trend in favour of Clean Samaru Dan Warri when compared to infected material of the same strain, the yield difference being of the order of 1,000 lb. per acre (about 10 per cent).

(c) *Clones Yield Trial—A12 (51)*.—Fifteen varieties were tested in a yield trial. The varieties, except for CH 28, Dan Warri and Two Cent, were clones of open pollinated seedlings grown in 1946. Code letters of the female parents of these clones are as follows :—

A—Maiduguri Dan Warri
 B—Ibadan GC 997B
 C—Ibadan C/36/95
 E—Ibadan CH 28
 H—Minna GC 997B

The following table compares yields (lb. tubers/acre) obtained in the 1951 and 1952 harvests :—

"Variety" or Clone				A8 (50)	A12 (51)	Average
"CH 50"	..	..	..	13,407	19,219	16,313
B 18	..	..	..	10,959	17,451	14,205
"Dan Warri"	..	..	..	8,857	19,421	14,139
E 2	..	..	..	12,944	13,807	13,375
C 15	..	..	..	13,309	13,161	13,235
B 17	..	..	..	12,715	12,678	12,696
C 5	..	..	..	9,843	14,828	12,335
"Two Cent"	..	..	..	10,794	13,398	12,096
B 21	..	..	..	8,107	7,323	11,650
H 1	..	..	..	6,001	15,193	10,597
"CH 28"	..	..	..	8,519	11,504	10,011
C 23	..	..	..	3,011	11,386	7,198
B 9	..	..	..	5,000	4,593	4,786
B 26	..	..	..	—	7,480	(7,480)
A 2	..	..	..	—	5,428	(5,428)
Sig. diff. 5%				4,756	5,901	—
1%				6,422	7,860	—

The only conclusion that can be drawn, so far, is that B9, B26 and A2 are not satisfactory yielders. None of the clones appears likely to out-yield CH50 or Dan Warri.

(d) *Length of Cuttings Observation*.—Observation tests were made on cuttings of mosaic infected Dan Warri *ex-Zonkwa*. The cuttings were cut to lengths of 6", 9", 12" and 15".

Yields recorded from these cuttings are shown below :—

12"	..	..	..	13,613 lb. in tubers per acre
15"	..	..	..	12,958 " "
6"	..	..	..	12,806 " "
9"	..	..	..	8,873 " "

These results are not conclusive but it would appear that 12" lengths give the best yields. The discrepancy between 6" and 9" lengths is difficult to explain.

The trial is being repeated. The question is of importance, because in this Region the over-ground growth of Cassava is much lighter than in the South, and the multiplication of varieties is very slow. It is therefore necessary to use the shortest satisfactory length of cutting.

NURSERY WORK

(a) *Ornamental Shrubs*.—Propagation and distribution of ornamental shrubs was continued. Landscaping of the new Senior Service Quarters at Samaru has been undertaken and satisfactory progress has been made. New avenues are being planted with trees and hedges.

Attempts to obtain ornamental shrubs from Ibadan have met with no response and it is hoped that materials will be forthcoming next season.

(b) *Vegetable Trials*.—A series of observation trials have been conducted to determine the varieties best suited to Northern Nigerian conditions.

Times of planting, best growing season (wet or dry) and irrigation requirements are also being studied. Results do not at this stage justify a detailed report.

(c) *Citrus and other Fruits*.—Propagation of citrus and other fruits for distribution mainly on Samaru has continued. Budwood is taken from proved trees or obtained from Ibadan and Yandev.

Seeds of rough lemon are being distributed to outstations in the North to meet the demand created by the opening of new nurseries.

Seeds of Tangelo (vars. Sampson and Lake) have been sent to most stations for test as root stock, scion and seedling. The Chemist has undertaken to conduct juice analyses on all citrus growing in the orchard. Fruits of all trees will be tested in due course and a combined report will be presented. Quality of citrus at Samaru is relatively good considering the fact that no irrigation is carried out during the long dry season.

A water storage tank has been constructed in the nursery and it is hoped that water supplies will be sufficient for a small scale irrigation trial during the 1953-54 dry season if materials arrive in time.

STOCK PLOTS

Stock plots of all varieties still on the "not discarded" list were maintained to ensure supplies of pure seed either for further work when required or for distribution to outstations. In the case of the more important varieties, larger scale multiplication plots were also maintained. This work involves a considerable amount of detailed attention and recording.

INTRODUCTIONS

During the year, 143 new introductions were made, as detailed below. (It should be noted that some of the more unlikely ones were unsolicited gifts from other countries): —

<i>Crop</i>	<i>No. of Varieties</i>	<i>Source</i>	<i>Remarks</i>
Maize	13	U.S.A.	Mainly single and double cross hybrids.
Rice	52	Burma, N.E.I.	
Sugar Cane	7	Swaziland	Various local varieties.
Acha	1	South Africa	400 and 500 series of Co. Varieties.
Wheat, Rye, Oats, Barley ..	7	French Guinea	(<i>Digitaria exilis</i>).
Grasses	11	Finland	
Groundnuts	17	East Africa, etc.	
Other legumes	15	Congo, N.E.I.	
Fruits	9	Various	Mainly fodder and pasture species.
Fibres	1	Bermuda, etc.	
Benniseed	10	Gold Coast	<i>Abroma augusta</i> .
		U.S.A.	

These have been established for observation and multiplication.

B.—WORK AT OUTSTATIONS

POLICY

The Botanist is responsible for the testing of varieties of crops on outstations in the North. Variety trials are originated either by the Botanist or by the Provincial Agricultural Officers but final decisions are made at the Cropping Schemes Committee meetings.

The general procedure consists of several steps before a given variety is included in a trial. If it is a new variety, it will be first grown at Samaru for observation and multiplication. It is then sent to stations where it is believed it may be suitable. At these stations it is grown

in "Farm Gardens" and its performance in small plots is recorded. If its yield and general characteristics are considered suitable, it is included in a series of variety trials. After passing successfully through these stages it may be recommended for general distribution in a given area.

GROUNDNUTS

(a) *General*.—The development of higher yielding varieties of groundnuts has been the aim of this section for many years and some excellent results have been obtained in the past. Kano 38 and Kano 50 have been successful in the Kano area. Castle Cary and Samaru 38 have been spread throughout the Region except Kano and the extreme north, and are now widely grown.

These varieties have, with the notable exception of the extreme north, been generally heavier yielders than the local types. In some areas, the "local" type now contains a strong admixture of these improved strains and it is therefore more difficult to produce varieties which are unquestionably better.

(b) *Kano*.—A variety trial was carried out in 1952 but it was discovered, during the growing season, that the seed had been hopelessly mixed and that Kano Local Spreading seed had been substituted for some of the Botanist's strains.

The Agronomist's report contains the results of a series of experiments in Kano Province in which Kano 50 and Local Spreading were grown under different conditions (see page 5).

(c) *Daura (Katsina Province)*.—Results from Daura are generally disappointing. We have not yet developed a strain which will yield consistently better than the local type.

A constant difficulty at Daura has been in the establishment of anything like a full stand, and it has nearly always been necessary to adjust yields (by regression) for deficient stand count. Under conditions of very incomplete stand, the spreading variety is at an advantage compared with the upright, as it is better able to make use of the fortuitous vacant areas, and this may be one reason for the success of the local variety at Daura.

The yields from experiment No. D1 (52) are shown below, together with a comparison of previous years' results, and annual stand counts.

DAURA GROUNDNUT VARIETY TRIALS

YIELDS KERNEL LB./ACRE, 1947-51

	Years:		1952	1951	1950	1949	1947
			Sig. (P=5%)	Sig. (P=0.1%)	Sig. (P=0.1%)	Sig. (P=1%)	Sig. (P=1%)
<i>Varieties:</i>							
Samaru 38			348 (7)	320 (7)	76 (7)	380 (3)	288 (2)
Castle Cary			353 (5)	396 (4)	710 (1)	—	—
Bagobira			379 (2)	475 (2)	183 (4)	375 (4)	190 (5)
MH 375			351 (6)	329 (6)	143 (5)	409 (2)	283 (3)
Gusau Semi Upright			408 (1)	466 (3)	130 (6)	360 (5)	158 (6)
Local Spreading			370 (4)	907 (1)	613 (2)	559 (1)	374 (1)
Kano 38			375 (3)	372 (5)	206 (3)	375 (4)	268 (4)
M.P.D.			277 (8)	308 (8)	29 (8)	256 (6)	190 (5)
S.E.			25	38	32	17	17
5% Sig. diff.			81	109	93	48	49
1% " " " "			—	146	124	65	67
0.1% Sig. diff.			—	194	164	—	—

PERCENTAGE STAND COUNTS AT HARVEST

				<i>L.S.</i>	<i>C.C.</i>	<i>B.B.</i>	<i>K. 38</i>	<i>G.S.U.</i>	<i>MH.375</i>	<i>S. 38</i>	<i>M.D.</i>
1949	..	..	..	39.7	—	43.7	22.8	30.9	15.4	56.3	40.5
1950	..	..	..	71.6	88.8	18.4	29.1	13.5	14.9	8.2	23.3
1951	..	..	..	41.9	22.5	18.9	18.4	16.6	13.5	13.5	25.9
1952	..	..	..	86.7	76.8	82.8	85.2	81.6	80.2	73.1	70.3
Average	..	..	..	60.0	62.7	41.0	38.9	35.7	31.0	37.8	40.0

(*d*) *Kafinsoli* (*Katsina Province*).—At the moment, *Castle Cary* is conditionally recommended in this area but it is hoped that it will be replaced by some other variety in the future.

The analysis of experiment No. 12 (52) is shown below : *Natal Common* has kept its place better here than elsewhere, possibly on account of its earlier maturity.

SUMMARY OF YIELDS LB./AC.—KERNELS

<i>Variety</i>	1951		1952	
	<i>Not Sig.</i>		<i>Not Sig.</i>	
<i>Kano 50</i>	..	..	1,493	600
<i>Natal Common</i>	..	..	1,469	581
<i>Local Spreading</i>	..	..	—	563
<i>M.J. 374</i>	..	..	1,516	556
<i>Castle Cary</i>	..	..	1,441	542
<i>S.E.</i>	..	..	±49	±36

(*e*) *Sokoto*.—Although minor variety trials have taken place at *Sokoto* since 1933, *Castle Cary* has been the only variety recommended. It has almost consistently out-yielded *Local Spreading*, being ahead in ten trials out of twelve.

A summary of experiment No. 02 (52) is shown below :—

EXPERIMENT 02 (52)

SUMMARY OF YIELDS KERNEL LB./ACRE

<i>Varieties</i>	<i>Sig. (F=1%)</i>	
<i>ML. 372</i>	..	1,155
<i>Castle Cary</i>	..	1,001
<i>Gusau Local Spreading</i>	..	984
<i>Natal Common</i>	..	963
<i>Sokoto Local Spreading</i>	..	903
<i>M.P.C.</i>	..	661
<i>S.E.</i>	..	±70
5% <i>Sig. diff.</i>	..	204
1% „ „	..	276

(*f*) *Gusau* (*Sokoto Province*).—The two varieties recommended for *Gusau* are *Castle Cary* and *Gusau*. The *Gusau* variety is more unreliable than *Castle Cary* but occasionally out-yields it.

The results of experiment No. G2 (52) are presented below, together with 1951 yields:—

SUMMARY OF YIELDS : GROUNDNUT KERNEL—LB/ACRE

<i>Varieties</i>	1951		1952	
	<i>H. Sig. (P=0.1%)</i>		<i>Sig. (P=1%)</i>	
<i>Gusau</i>	..	693	1,145	
<i>Kano 50</i>	..	960	1,100	
<i>Castle Cary</i>	..	813	1,065	
<i>Natal Common</i>	..	415	960	
<i>S.E.</i>	..	±40	±35	
5% <i>Sig. diff.</i>	..	119	102	
1% „ „	..	162	139	
0.1% „ „	..	220	—	

(g) *Kontagora Groundnut Farm (Niger Province)*.—Yields on this farm have not been high. The most promising strains to date are MK. 383, Samaru 38 and Kano 50.

The statistical analysis of experiment No. TP2 (52) is presented below :—

KONTAGORA GROUNDNUT FARM—VARIETY TRIALS LB/ACRE KERNELS

Variety					1949	1950	1951	1952	Average
Samaru 38	..	..	..	..	822 (1)	398 (1)	237 (6)	325 (6)	460 (1)
MK. 383	..	..	..	..	851 (3)	240 (8)	269 (1)	467 (1)	457 (2)
Kano 50	..	..	..	..	—	—	—	443 (2)	[443] (3)
M.K. 374	..	..	..	..	793 (5)	290 (6)	199 (9)	355 (4)	409 (4)
Castle Cary	..	..	..	..	747 (8)	319 (3)	222 (7)	341 (5)	407 (5)
MJ. 374	..	..	..	..	819 (4)	314 (4)	240 (5)	252 (8)	406 (6)
MG. 371	..	..	..	..	684 (9)	347 (2)	221 (8)	364 (3)	404 (7)
Natal Common	..	..	..	..	862 (2)	308 (5)	243 (4)	176 (9)	397 (8)
ML. 372	..	..	..	..	776 (7)	264 (7)	259 (3)	279 (7)	394 (9)
1% Sig. diff.	..	..	..	..	Not Sig.	Not Sig.	Not Sig.	90	—
5% „ „	..	..	..	..	—	—	—	124	—
0.1% „ „	..	..	..	..	—	—	—	171	—

(Relative placing in trial shown in parentheses).

Yields have been low in most years, due mainly to late planting. Samaru 38 and MK. 383 have been fairly consistent, and Kano 50, in trial for the first time in 1952, shows promise.

(h) *Bida (Niger Province)*.—An experiment was undertaken at Bida in 1952 to determine whether the strains maintained at that station were the same as the material originally sent to them. The experiment also included two Samaru strains, MK. 383 and MJ. 371.

A summary of the results of trial No. E1 (52) is presented below :—

SUMMARY OF YIELDS LB/AC. KERNELS

Varieties					Not significant
Botanist Castle Cary	..	..	..	..	444
Botanist S. 38	..	..	..	..	400
MK. 383	..	..	..	..	396
MJ. 371	..	..	..	..	385
Bida S. 38	..	..	..	..	378
Bida Castle Cary	..	..	..	..	360
S.E.	..	..	..	..	±29

Result.—Varieties are not significantly different. There are indications, however, that the Botanist Castle Cary and S. 38 may be higher yielders than the Bida strains.

(i) *Yola (Adamawa Province)*.—Recent experiments with groundnuts at Yola have been inconclusive. Variety trials conducted from 1949 to 1952 gave insignificant results.

A summary of results of experiment No. Y5 (52) is presented below :—

SUMMARY OF YIELDS KERNEL LB/ACRE

Varieties					Not significant
Verre upright	..	..	..	..	602
Layoji	..	..	..	..	539
Castle Cary	..	..	..	..	495
MJ. 374	..	..	..	..	477
Natal Common	..	..	..	..	466
Samaru 38	..	..	..	..	414
S.E.	..	..	..	..	±54

Local American (about an average performer among the short season varieties) was common to the 1947 and 1952 long season trials. It is fairly clear therefore that long season varieties at Zonkwa can out-yield short season ones. It must however be borne in mind that in this area short season groundnuts are commonly grown and followed by transplanted Dauro, so that a long season variety would not at present be generally acceptable.

GUINEA CORN

(a) *General*.—The variety experiments on guineacorn, undertaken at outstations, are mostly the result of selections from local types made by Provincial Agricultural Officers. In some cases segregation of plant characteristics has been the criterion on which the selections have been made. In others it has been simply a comparison of several methods of selection while some trials are designed to test different strains found in the locality.

Dr Webster's sorghum varieties are being tried in certain specified areas but results of these tests are inconclusive at this time and further trial is required.

The tests at Riyom and Bauchi were a complete failure while yields at Daura and Kafinsoli were disappointingly low. Kano, on the other hand, had a good yield of 1,140 lb. per acre of Ladore variety.

Maɗuguri produced the best results as shown by the following grain yields :—

Ladore	..	..	..	..	1,588 lb. per acre
Hegari	..	..	..	..	1,554 „ „
Dwarf Kaffir	..	..	..	..	1,230 „ „
Combine 60	..	..	..	..	1,190 „ „

(b) *Gusau (Sokoto Province)*.—The Provincial S.A.O. has made selections within Farafara and Kaura varieties and these were tested in Yield Trial No. G3 (52).

A summary of this trial is presented below :—

SUMMARY OF YIELDS : THRESHED GRAIN—LB/AC

Varieties				1952
				Not significant
C=Kwarbiyu (Farafara—White 2 seeded and Compact head)	..	..	..	1,340
E=Farafara (White Loose Head)	..	..	..	1,291
A=Farm Centre (Kaura—Yellow Loose Head)	..	..	..	1,094
B=Bunding Saniya (Kaura—Yellow and Loose Head)	..	..	..	1,093
D=Farafara (White and compact head)	..	..	..	1,067
S.E.	..	..	..	±145

There is no significant difference between the varieties.

(c) *Sokoto*.—Four varieties of guineacorn from Sokoto and the surrounding area were tested in Yield Trial No. 03 (52).

A summary of results of this experiment is presented below :—

SUMMARY OF YIELDS GRAIN LB./ACRE

Varieties				1952	1950
				Sig. (P=5%)	Sig. (P=0.1%)
Jaddawa	..	..	..	742	526
Bagoba	..	..	..	600	—
Janjare	..	..	..	585	—
Yardarara	..	..	..	396	—
Talabani	..	..	..	—	253
Farafara	..	..	..	—	Failed.
5% Sig. diff.	..	..	..	213	

Jaddawa is easily the best, and significantly out-yielded Yardarara (*ex-Gwadabawa* district in Sokoto). Other differences are not significant. It is worthy to note that in 1950, Jaddawa also out-yielded Talabani by a significant amount. Farafara was a complete failure in that year and was therefore eliminated from subsequent trials.

(d) *Yola (Adamawa Province)*.—Selections were made on the basis of seed colour by the Provincial Agricultural Officer. These were tested in 1951 and 1952 against the mixed Local Varieties.

Results are shown in the following summary :—

SUMMARY OF YIELDS, DRY THRESHED GRAIN, LB./ACRE				
<i>Varieties</i>				
			1951	1952
			<i>Not significant</i>	<i>Not significant</i>
Y.M. 548 Light brown grain	..	..	749	852
Local Mixture	..	..	—	841
Y.M. 448 Red Grain	..	..	744	782
Y.M. 348 Cream Grain	..	..	719	737
Y.M. 148 White Grain	..	..	799	720
S.E.	..	..	±47	±39

There are no significant differences between the varieties nor any indication that any of the strains is superior.

(e) *Maiduguri (Bornu Province)*.—Four local varieties have been tested in 1951 and 1952. Results of these two trials are presented below :—

SUMMARY OF YIELDS LB./ACRE GRAIN				
<i>Varieties</i>				
			1951	1952
			<i>H.Sig. (P=0.1%)</i>	<i>Sig. (P=1%)</i>
Shambul	..	..	952	1,321
Abada	..	..	1,104	1,249
Bikalmayo	..	..	610	1,018
Jigari	..	..	545	1,012
5% Sig. diff.	..	..	192	209
1% „ „	..	..	262	285

Yields were better than those of last year. Shambul and Abada are consistently better than the other two varieties, the differences being significant in both years. No significant difference has appeared between the two better yielders. (Shambul and Abada).

SOYA BEAN

(a) *General*.—The growing of soya beans has been left to stations in the “Middle Belt” where this crop is slowly finding its way into the economy of the Region. In Benue Province it has found its place as a cash crop along side of Benniseed and has not interfered with this latter crop.

A soya bean trial has also been carried out at Riyom to determine whether the crop might be successfully grown on the Plateau.

(b) *Yandev (Benue Province)*.—Several varieties of Soya bean were sent to Yandev after it was found that they yielded well at Samaru. Nine varieties were placed in trial No. V5 (52), the results of which are presented below.

SUMMARY OF YIELDS LB./ACRE THRESHED SEED				
<i>Varieties</i>				
			<i>Sig. (P=1%)</i>	<i>(Position)</i>
Malayan	..	..	667	(1)
Yellow Bermelly	..	..	608	(2)
Bilomi No. 3	..	..	579	(3)
Black Matted Java	..	..	541	(4)
Benares	..	..	518	(5)
Dixie	..	..	499	(6)
28 E.B.	..	..	491	(7)
Bilomi No. 1	..	..	444	(8)
Miscellaneous 94	..	..	434	(9)
5% Sig. diff.	..	..	108	—
1% „ „	..	..	144	—

Malayan, which has given the highest yield, is significantly superior to all varieties except Yellow Bermelley and Bilomi No. 3. Misc. 94 and Bilomi No. 1 are significantly worse than Yellow Bermelley and Bilomi No. 3. Other differences, although high are not significant. (Compare Samaru trial, page 26).

(c) *Riyom (Plateau Province)*.—A trial was planted in 1952 to determine the suitability of several soya bean varieties to conditions on the Plateau.

The yields were extremely good for Riyom conditions and it is hoped to repeat the experiment in 1953.

The results of experiment No. R3 (52) are presented below :—

SUMMARY OF YIELDS LB./ACRE					THRESHED SEEDS
<i>Varieties</i>					<i>Sig. (P=1%)</i>
(2) Bilomi No. 1	..	..	..	..	820
(4) Misc. 94	..	..	..	..	764
(3) Bilomi No. 3	..	..	..	..	684
(5) Black Matted Java	..	..	..	..	647
(7) Benares	..	..	..	..	614
(9) 28 E.B.	..	..	..	..	614
(6) Yellow Bermelley	..	..	..	..	567
(8) Malayan	..	..	..	..	554
(1) Dixie	..	..	..	..	544
5% Sig. diff.					107
1% „ „	..	..	..	..	143

CASSAVA

(a) *General*.—The greatest emphasis on Cassava work has been placed on determining the effect of mosaic infection on yields.

Conclusive results have not been obtained and heavily infected plants occasionally out-yielded their resistant counterparts.

Results of cassava experiments are invariably late in reaching here as the crop is harvested during the wet season.

(b) *Yandev (Benue Province)*.—Five mosaic resistant varieties have been tested against the local susceptible variety.

Results of experiment No. V2 (51) are presented below :—

SUMMARY OF YIELDS TUBERS LB./PLOT AND PER CENT					MOSAIC INFECTION
(1) Local Variety	..	..	..	..	5,619 57.6
(2) CH 28	..	..	..	..	6,949 —
(3) CH 50	..	..	..	..	8,645 —
(4) C36/95	..	..	..	..	6,711 —
(5) C36/33	..	..	..	..	9,099 —
(6) CC 997B	..	..	..	..	11,237 —
S.E.	..	..	..	..	917
5% Sig. diff.	..	..	..	..	±2,764
1% „ „	..	..	..	..	3,822

The local was the only susceptible variety, showing 57.6 per cent mosaic infection. The other five proved resistant, and were superior to the local in yield.

Previous results obtained in 1949 and 1951, showed that local, although highly susceptible to mosaic, gave higher yield than all other varieties, differences in yield were however not significant.

BENNISEED—(SESAMUM INDICUM)

(a) *General*.—All selection work and yield trials on this crop are carried out at Yandev. The aim of the selection programme is to develop strains of (a) earlier maturing plants and (b) heavier yielding plants.

Results to date are encouraging and it is hoped that improved strains will be available for distribution in the near future.

Further selections were made in 1952 and these will be planted this year.

(b) *Early Selections, Family and Strains Trial*.—This trial consisted of strains reselected in twelve families earlier selected for early maturity and apparently retaining this earliness. There were six randomised block of nine families. It was necessary, in some cases, to group two families together to make a set of six strains per family. Unselected Yandev was used as control.

The following 1949 selections are represented :—

1949 Selection No.						Family
66-12 strains	..	..	..	..	..	D and E
189- 6	„	..	..	..	..	A
137-66	„	..	..	..	..	B
152- 6	„	..	..	..	..	C
181- 3	„	grouped as one family			..	F
98- 3	„				..	
172- 4	„				..	
192- 2	„				..	G
109- 3	„	„			..	H
167- 3	„				..	
120- 3	„				..	
4- 3	„	„			..	J
Yandev Unselected	..				..	U

Analysis of results was done on the basis of :

(a) Yield

(b) Relative earliness.

To determine the earliness on a numerical basis, the percentage of mature plants was taken at the time when the first few plants of Yandev Unselected benniseed (planted at the same date) were beginning to reach maturity.

Analysis of yields of strains within families was performed and significant differences were formed in families A, E, F and J. This could have been expected in families F and J due to their composite make-up.

The analysis between families on the basis of yield, gave the following results:—

SUMMARY OF YIELDS LB./ACRE					
	Family No.				lb./Acre
A	..	..	..	..	373.74
H	..	..	..	..	346.96
J	..	..	..	..	310.57
D	..	..	..	..	299.11
U	..	..	..	..	293.20
B	..	..	..	..	279.79
E	..	..	..	..	272.39
C	..	..	..	..	265.07
F	..	..	..	..	259.05
G	..	..	..	..	236.18
5% Sig. diff.	..	..	..	..	68.35
1% „ „	..	..	..	..	91.45
0.1% „ „	..	..	..	..	120.10

Although results are significant, only one family i.e., A, yielded better than Yandev Unselected at the 5 per cent point. When these yields are considered in relation to earliness, it can be seen that the highest yielding family was the latest to reach maturity.

The following "percentage maturities" were obtained for the various families, and they were transformed for analysis by using Fisher and Yates "Angular Transformation of Percentages to degrees".

Family			Per cent mature plants	Per cent transformed to degrees	Average No. of days to full maturity
F	..	..	47.5	43.6	99.2
B	..	..	42.0	40.4	92.2
C	..	..	21.3	27.5	94.6
J	..	..	11.9	20.2	96.9
D	..	..	11.7	20.0	96.6
H	..	..	11.3	19.7	93.3
E	..	..	10.7	19.1	97.5
G	..	..	10.4	18.8	97.0
A	..	..	6.8	15.1	98.0
U	..	..	2.6	9.2	104.0
Sig. diff. at 5 per cent			..	..	13.5
" " 1			..	..	18.1
" " 0.1			..	..	23.8

It is clear from the above figures that the characteristic of earliness is being maintained by some of our new strains. On the basis of percentage of mature plants, families F and B have done very well and family B reached full maturity in about ninety-two days compared to 104 for the Unselected Yandev seed. This difference of twelve days can be of great value in Benue Province where it is essential that the plants mature in the "short dry" season. It is particularly useful when a late start in the rains necessitates later than normal planting.

Analysis of earliness within families was also carried out and results indicate a significant difference between strains in families B, F, G, H and J.

As a whole, it is considered that results to-date have been well worth the time and effort put into this breeding programme. The work will continue and it is hoped that we may, in due course, obtain some strains which combine the desirable characteristics of earliness and high yielding capacity.

NORMAL MATURITY BENNISEED YIELD TRIAL

As a result of the selection work on Benniseed, high yielding strains have been collected and a few of these have maintained this desirable character since 1949. It was decided, therefore, to place two of these strains in a small replicated trial to compare them with Yandev Unselected seed.

The following results were obtained :—

Strain 055	..	..	501 lb. per acre
Strain 064	..	..	453 "
Unselected	..	..	428 "

Although results were statistically insignificant, there is a trend in favour of the selected strains. The trial will be repeated in 1953.

PESTS AND DISEASES

(a) *General.* —Although we have no plant Pathologist or Government Entomologist, stationed in the Northern Region, this section has been co-operating with specialists in the South in the matter of pests and diseases.

During the year, the Botanist made several tours of sugar growing areas to inspect the damage caused by Red Rot.

(b) *Red Rot of Sugar Cane*.—The most serious disease in the Northern Region has been the outbreak of Red Rot of sugar cane (*Colletotrichum falcatum*). This disease has now been found in the following provinces :—

Zaria	South East Sokoto
Southern Kano	Ilorin
Southern Katsina	Adamawa

It would appear from reports, that the disease has not caused as much damage as in the previous year but it is still spreading and has cut deeply into cane growers' revenue.

Varieties said to be resistant are being introduced by the Research Adviser and canes will be sent North as soon as practicable for resistance tests. Due to the difficulty involved in rapid multiplication, it will take a long time before any resistant canes can be made available for large scale distribution. It appears possible from observation that some of the cane varieties grown in certain areas may have a degree of resistance to Red Rot and cuttings have been brought to Samaru for multiplication and trial.

(c) *Groundnut Diseases*.—Rosette was found at all stations visited by the Botanist during the year. Damage in the Northern Groundnut Belt was not considerable but was more serious in late planted fields, as might be expected. The virus was of greater importance in the Middle Belt and was particularly heavy in the late planted fields at Mokwa.

Leaf spot (*Cercospora personata*) is present in all areas and appears to be more prevalent on the early maturing varieties of groundnuts. There is no indication however, that yields are adversely affected to any extent by this disease.

Root rot (*Sclerotium rolfsii*) was found to be on the increase at the Bida Farm and nearly all experimental plots were seriously affected. It was found that nearby farmers' fields did not suffer to the same degree.

A report from Adamawa indicates that root rot or some similar disease caused heavy damage in certain areas of that province.

(d) *Benniseed Diseases*.—A wilt disease was discovered in the Benniseed Selection trials at Yandev. This disease affected some strains more than others and reduced yields considerably in some cases. The disease was tentatively identified as *Macrophomina phaseoli* by the Research Adviser.

(e) *Maize Rust*.—The survey conducted in Ibadan was provided with figures from the North. It would appear that the disease is of minor importance, although present, in the Northern belt. It is of considerable importance, however, in the Middle Belt.

Borers caused considerable damage in some areas.

(f) *Guineacorn Diseases*.—Covered Smut was found in all areas and recommendations were again issued to all outstations to treat seed with Copper Carbonate.

Borers and Striga are to be found in all areas but there is no information available on the damage caused by these two conditions.

(g) *Citrus Diseases and Deficiencies*.—The most recurrent complaint received has been about sooty mould. Typed recommendations are now available for distribution to anyone interested.

Nutrient deficiencies often caused by wrong water or soil conditions have been found in many orchards. This is being investigated with the co-operation of the Chemist.

The recommendations of the Research Adviser regarding root stocks are being put into effect.

Gummosis has been reported from several stations, the degree of infection varying greatly.

CITRUS STUDIES

During the year, the Botanist toured some parts of the Northern Region to inspect orchards and sites for new nurseries. A report on this has already been presented.

Irrigation requirements of citrus merit special consideration in this Region. Instructions have been received from the Regional Director to conduct investigations along these lines at Samaru and several outstations. The Botanist had previously written a report on this subject.

G79 RICE MULTIPLICATION

The G79 multiplication scheme has had to be reconsidered during 1952. It was found that the seed produced for distribution at the main multiplication farm at Maigana was of a very low purity. Seven separate varieties were found growing with it.

The Botanist was assigned the task of improving the quality of G79 and a system of drastic roguing was introduced. New seed of G79 was also obtained and has been multiplied.

Results at the end of the year show that purity has been improved but there is still a percentage of rogue seeds present. Further roguing will be done in 1953 and it is hoped that by 1954, normal distribution of a high grade of G79 rice can be resumed.

Routine purity checks of G79 grown at all stations are now being made to determine the extent of contamination in each area.

IV.—CHEMISTRY SECTION

By H. Irving

SULPHUR INVESTIGATIONS

The effects of sulphur on yields of groundnuts have been investigated during the past four years at Kontagora in Niger Province and at the Northern Research Station, Samaru. Applications of sulphur-containing compounds either as a dust or a soil amendment have almost invariably produced significant increases at Kontagora on both kernel and haulm yields. At Samaru however, the effect has not been consistent, varying with year and soil conditions.

In addition to examining the residual effects of previous sulphur treatments this year, a new set of experiments was laid down to investigate the effect of sulphates applied in the base forms of Calcium, Magnesium and Sodium, at two levels of application. Four such experiments were laid down one each at Kontagora, Samaru, Kano and Yola. The latter two sites are centred in large groundnut growing areas and were included to ascertain the sulphur status of the area.

The results of these new experiments were insignificant except at Kontagora where again sulphur applications have significantly increased the yield of both kernels and haulms.

Kontagora.—The three base forms of sulphates, all containing equal amounts of sulphur, have significantly increased the yields of kernels and haulms when applied at the double rates (equivalent to 17.2 lb. of sulphur per acre). The three types of sulphates did not differ significantly among themselves. The average effect was to increase kernel yield by 158 lb. (26.6 per cent) and haulm yield 589 lb. (61.2 per cent).

Samaru.—There was absolutely no effect on kernel or haulm yields due to the application of sulphur in any form. The applications did tend to be slightly deleterious in reducing shelling percentage as a whole. In the case of Sodium Sulphate a reduction of 2.8 per cent was obtained which is significant at the 5 per cent level.

Kano.—Here the trend of sulphate treatments is to decrease yields. The single rates all showed decreased yields and double rates with exception of calcium sulphate showed a further reduction.

Yola.—The trend at this station follows that of Kano as regards Magnesium and Sodium Sulphates, that is to show reduced yields with additional applications. Calcium Sulphate however showed slight increase for increased rates. All treatments tended to lower shelling percentages as at Samaru. It is stressed once more that these effects at Samaru, Kano and Yola are very slight, and do not begin to approach statistical significance.

RESIDUAL EFFECTS OF SULPHUR

Kontagora.—There were five experiments which had had some type of sulphur treatment in 1951. Three of these were planted to Mucuna in 1952 and showed no reaction to residual sulphur. The other two experiments were planted to groundnuts which gave no significant results. There was in both experiments a definite trend for increased haulm production on the sulphur treated plots. The kernel response was variable but in both cases calcium sulphate gave the best yields.

Calcium sulphate originally applied at the rate of 100 lb. per acre had given significant residual responses for three years. This year no further response was obtained, and the observations were concluded.

Samaru.—The residual effects of various sulphur compounds applied in 1951 were observed on five experiments, all of which were planted to groundnuts. The following table gives the yields and effects of sulphur treatments which have been extracted from the different experiments.

RESIDUAL SULPHUR EXPERIMENTS—1ST YEAR
KERNELS LB./ACRE

TREATMENT:							
<i>Nil</i>	<i>Sodium Sulphate</i>		<i>Calcium Sulphate</i>		<i>Sulphur</i>		
<i>Yield</i>	<i>Yield</i>	<i>Diff. to Nil</i>	<i>Yield</i>	<i>Diff. to Nil</i>	<i>Yield</i>	<i>Diff. to Nil</i>	
841	910	+69	1,000	+159xxx	—	—	—
417	469	+52	433	+16	392	—25	—
878	901	+23	892	+14	926	+48	—
433	456	+23	—	—	—	—	—
561	—	—	596	+35	547	—14	—
405	654	+249xxx	528	+123xxx	509	+104x	—
956	1,188	+232 x	1,319	+366xxx	—	—	—
684	745	+61	745	+61	725	+41	—
936	1,016	+80	1,067	+131	1,178	+242xx	—
1,001	1,097	+96x	—	—	—	—	—
1,047	—	—	1,194	+147	1,127	+80	—
926	1,245	+319	1,087	+161	1,107	+181	—

x, xx, xxx, denote 5 per cent, 1 per cent, and 0.1 per cent significance in particular experiment.

The above table shows, in spite of non-significance in many cases, a definite trend from residual sulphur treatments to increase both kernel and haulm yields at Samaru.

PHOSPHATE INVESTIGATIONS

This section of the report deals with phosphates as a single component. Investigations dealing with its interaction with F.Y.M. and other fertilisers and its place of application in rotations will be dealt with under permanent Manurial Experiments.

The Chemistry section has investigated the phosphate requirements of various crops in different areas of the Northern Region throughout the post war period. The requirements for guineacorn and groundnuts have been determined in particular areas where superphosphate is the only fertiliser required. Other investigations include placement, time of application and types of phosphate carriers, etc.

During the past year emphasis has been on the time of application to guineacorn, and to the residual effect of the different carriers used in 1951. All previous experiments having had phosphate treatments which showed residual effects in 1951 were continued to determine how long a residual effect would persist.

Time of Application.—There were six time of application experiments on guineacorn, one of cotton and one of millet. No results are available for millet as the crop was a failure at Sokoto where the experiment was sited.

Details for only four of the six guineacorn experiments are available and all of these have shown no significant effect due to time of application which considered three treatments (1) with seed (2) ten days after planting and (3) twenty days after planting.

The one experiment on cotton consisted of two treatments (1) at planting (2) at thinning time. The latter almost reached significance at the 5 per cent level giving an increase of 38 lb. (9 per cent) seed cotton per acre.

Phosphate Effect.—The above time of application experiments were also designed to compare equal rates of P_2O_5 applied as superphosphate and as monoammonium phosphate with each other and with no phosphate application. All of the four experiments examined to-date show a phosphate response in increased yield, two of the experiments being significant at 1 per cent level. There was no significant difference between superphosphate and monoammonium phosphate but monoammonium phosphate was persistently better by 3 to 9 per cent.

Residual Effects of Phosphate.—Residual results of phosphate applications follow the findings of previous years, which have normally shown an increase in yield (especially with groundnuts) where plots have had phosphate dressings. The trends are quite marked and often show significance, with superphosphate persistently better though not significant over other phosphate carriers. Residual effects lasting two years are fairly common, and there has been a case of residual effect persisting significantly to the fourth year after application.

FORTIFIED FARM YARD MANURE

The practice of fortifying F.Y.M. with phosphate in other countries to conserve nitrogen and balance the P_2O_5 content of farm yard manure, might be profitable under Nigerian conditions, and a series of seven experiments were set out as a preliminary trial. These experiments were located at Daura, Kano, Ilorin, Riyom, Samaru and Yola with test crops of guineacorn (4), groundnuts, early Maize and Tamba (one each). The experiments were designed to compare fortified F.Y.M. against normal F.Y.M., normal F.Y.M. with added superphosphate, superphosphate alone and all against no manure. All F.Y.M. treatments were at 3 tons per acre and the super when added in the field was a dressing equal to the amount of added super in 3 tons per acre of fortified F.Y.M. The results invariably show all treatments much superior to no manure with fortified F.Y.M. usually slightly superior to the others but not significantly superior. All the experiments have not as yet been analysed, but a typical result for guineacorn is as follows (in lb. per acre) at Daura :—

<i>Nil</i>	<i>Super</i>	<i>F.Y.M.</i>	<i>F.Y.M. + Super</i>	<i>Fortified F.Y.M.</i>
704	822	1,038	1,060	1,084

The indications are, therefore for slightly more efficient use of super by incorporating it in the making of the F.Y.M. rather than adding it in the field, but the most efficient use is by applying F.Y.M. and super to separate fields.

D.N.P.K. Experiments.—Experiments were laid down to determine the relative long term effects of fertilisers and organic manures applied annually, and their interactions, at a number of stations. The first five were set out in 1949 at Daura, Bida, Kano, Sokoto and Daudawa. Samaru and Yandev were added in 1950 followed by Maiduguri in 1951. In 1952 two more stations (Kafinsoli and Kwarre) were added to bring the total to twelve. It is impossible at this stage to give definite results but it is quite apparent that yields are being maintained, under the treatments that include heavier dressings of F.Y.M. and Superphosphate, on the earlier laid out experiments and that no deleterious effects have yet been observed resulting from repeated dressings of fertiliser even at the heaviest rates.

PERMANENT EXPERIMENTS

These experiments sited at most stations are supplementary to the D.N.P.K. trials. They consist of various combinations of F.Y.M. and fertilisers applied annually to maintain fertility under continuous cropping. These experiments are mostly in the second year of cropping under the experiment and it is too early to make any comment at this time.

N.P. EXPERIMENTS—ILORIN PROVINCE

In order to ascertain the fertiliser requirements for principal food crops in Ilorin Province a series of N.P. experiments were laid down at three centres. This is an area in which fertiliser requirements have not previously been fully investigated, containing soils differing considerably from those in the main "phosphate response" areas, and bordering the "nitrogen response" areas of the Western Region. Each centre had nine experiments three for each of the three principal food crops namely; yams, early maize and guineacorn. The three centres were Paiye, Ballah and Oke Oyi. The rates of application were: N1 and N2, 60 and 120 lb./acre respectively of Sulphate of Ammonia; P, 60 lb./acre superphosphate.

Yams.—The results are extremely variable in all centres with no significant results. There is however a definite indication that nitrogen is required to increase yields.

Early Maize.—In these experiments the fertilisers were applied to the early maize which was later interplanted with guineacorn. The following table gives the difference between treatment and the nil application in lb. grain per acre. Significance within each experiment is denoted by asterisks :—

Site	Early Maize			Interplanted Guineacorn		
	N1	N2	P1	N1	N2	P1
Paiye	—9	+25	+212**	+80	+ 5	+53*
	—50	—38	+144**	+27	+56	+116**
	—18	—76	+ 38	—59*	+39	+69**
Ballah	+105	+250**	+151**	—	Failed	—
	+89	+89	+166***	—14	—11	+21
	+166**	+226***	+68	—16	+2	—15
Oke Oyi	+156**	+208**	+67	All Failed		
	+167**	+231**	+42	" "	" "	" "
	+210***	+228***	+5	" "	" "	" "

These being the results of one year's set of trials must be viewed with caution pending the results of future trials. These preliminary trials indicate the need for phosphates and nitrogen for Paiye and Oke Oyi respectively; at Ballah however both types of fertilisers would be required for early maize crops. The fact that the guineacorn on all three experiments at Paiye responded significantly to phosphate applications to the early maize is interesting and worthy of further investigation.

Guineacorn.—In this set of experiments the fertiliser was applied to the Guineacorn which had been interplanted through early maize. Full details of the maize yields at Paiye and Ballah are not available. The Guineacorn crop at Oke Oyi, as in the previous set of experiments was for the most part a failure and the yields have been omitted from the following table :—

GUINEACORN					
Paiye			Ballah		
N1	N2	P1	N1	N2	P1
—10	+ 3	+58*	+30	+41	+137**
+1	+11	+91**	+172***	+200***	+171**
+30	—57	+221**	+20	+44	—24

These results tend to substantiate the need of phosphate for corn crops as indicated by the previous set of experiments for these two areas.

MINERAL DEFICIENCY INVESTIGATIONS

Leaf painting tests were carried out on citrus in several areas, in an attempt to discover whether the chlorosis present was due to a minor element deficiency, without success.

A chlorosis in neem seedlings at Maiduguri and Zaria forestry nurseries has been observed during the past two years. This section in co-operation with the Forestry Department has set up pot experiments to ascertain if the chlorosis is due to a mineral deficiency or a breakdown of chlorophyll by high temperatures during the latter part of the wet season.

LABORATORY ANALYSIS

The laboratory staff were fully engaged during the year on analysis of soils, feeding stuffs, plant material, fertilisers, etc.

A considerable number of fodder, silage and dung samples were analysed for the newly appointed Pasture Research Officer in connection with his feeding trials at Shika.

V.—COTTON SECTION

The present report is complete at the time of writing, but final results are not yet fully available, and the final report will be separately published by the Empire Cotton Growing Corporation as "Progress Report from Experiment Stations, 1952-53: Northern Nigeria".

A.—COTTON BREEDING

By H. E. King

The programme of work on cotton this season has been a large one comprising replicated tests of progenies, small bulks from new selections and substrains from previous selection work already found promising in earlier trials. Some of the latter, all of Samaru 26C origin, were included in a series of "district variety tests" at stations scattered through the cotton belt.

In all, the replicated tests included a total of 2,100 separate plots. The weighing, sampling, ginning, lint measurements and other laboratory determinations, together with the statistical analyses involved, are still barely finished and the full consideration of all the results is not yet completed.

The main conclusions on which the coming season's programme has been based are given in this report together with some only of the numerical data illustrating the results obtained.

In so far as yields of timely-planted well-cultivated cotton are concerned the season must be considered quite a favourable one. Yields at Samaru were as high as those of the previous season. In a few fields indeed they were higher a figure of 1,000 lb. seed-cotton per acre being attained on some plots of moderate size for the first time (previous figures as high as this have been for extremely small plots only).

Pests and diseases were in general not unduly severe in incidence. Damage to foliage by *Mirids* (*Campylomma* and/or *Lygus spp.*) was less than last season throughout most of the experimental plots. Bacterial blight (*Xanthomonas malvacearum*) was, however, very definitely more in evidence than in either of the two previous seasons. How much reduction in yield of cotton in Northern Nigeria can be attributed to this disease in its several manifestations (angular leaf spot, vein blight, blackarm and bacterial boll rot) is not yet clear but it seems probably that it can in some seasons be responsible for much damage to bolls. At the same time differences between strains in the severity of symptoms displayed (in some cases related to known differences in genetic make up in terms of resistance genes) are not related obviously to differences in yield. "MU8A", a known susceptible type, fairly consistently out-yields some strains of known high resistance. Seasonal variations in the magnitude of the advantage shown by one strain over another have not yet been sufficiently accurately determined but MU8A did in fact this season give a smaller increase over 26C than in previous trials.

The heavier incidence of this disease this season enabled clear differences to be detected by field observation between selections from Samaru 26C believed in previous seasons to be all satisfactorily resistant.

One in particular, 4998-14, which had a good record for yield and other characters and which had been a contributor to the new mixture known as "Select Progeny Bulk" made up last season, was clearly not good enough under the more severe conditions. It stood out beyond doubt in some plots as susceptible to heavy leaf damage and elsewhere (including some of the district variety tests) it could be detected by careful examination as inferior in resistance.

The yields in replicated experiments of this strain, and of the Select Progeny Bulk of which it was a component, did not show any drop which could be attributed to bacterial blight but the Select Progeny Bulk in multiplication at Daudawa showed widespread symptoms and gave a most disappointing yield. It was considered best therefore to drop both the strain and the mixture, particularly as the previous season's bulking of "New Nucleus Stock" did so well this year that the "Select Progeny Bulk" had no strong claim to go forward as a replacement. Yields of these stocks are given in the sections following.

SEED STOCKS TRIAL

Eight seed stocks were tested in replicated experiments at Samaru and Daudawa. The results of the two tests are given in Table I.

TABLE I.—YIELDS OF SEED STOCKS TRIALS AT SAMARU AND DAUDAWA, 1952-53

Seed Stock	Samaru			Daudawa			Mean Lint Yield
	SC	Gin per cent	Lint	SC	Gin per cent	Lint	
Allen	517	31.5	163	381	32.1	122	—
Ex-Mai Inchi			(100)			(100)	(100)
1st Wave 26C	543	33.1	180	382	33.8	129	—
Ex-Stage F			(110)			(106)	(108)
2nd Wave 26C	571	34.0	194	449	34.7	156	—
Ex-Stage E			(119)			(128)	(123)
3rd Wave 26C	596	34.7	207	396	35.1	139	—
Ex-Stage D			(127)			(114)	(121)
4th Wave 26C	591	34.7	205	370	35.5	131	—
Ex-Stage C			(126)			(107)	(118)
5th Wave 26C	571	35.2	201	406	35.7	145	—
Ex-Stage B			(123)			(119)	(121)
New Nucleus Stock ..	615	35.7	220	438	35.6	156	—
Ex-Samaru			(136)			(128)	(132)
Select Progeny Bulk ..	585	34.9	204	423	34.9	148	—
			(125)			(121)	(124)
S.E.	20.3	—	6.9	21.1	—	7.3	—
			(4.3)			(6.0)	(3.5)

Seed-Cotton and Lint yields are given in lb. per acre and (in brackets) as percentage of yield of Allen.

In spite of the fact that the decision to change over from Allen to Samaru 26C as the commercial crop for Northern Nigeria had already been firmly taken on adequate evidence from previous tests (going right back to 1939-40) one stock of Allen was included. This, obtained from Mai Inchi ginnery area, was thought likely to be more nearly representative of the old unimproved Allen than the stocks used for trials in 1949-50 and 1950-51.

The comparison of this Mai Inchi seed with 26C confirmed the belief that the smaller differences obtained between "Allen" and 26C in those two seasons were due to the Zaria and Funtua Allen stocks having been appreciably "graded up" by admixture with early issues of 26C and its predecessors.

The figures for ginning percentage of the first wave 26C suggest strongly that this seed, which has gone through five seasons of multiplication since issue from Samaru, has suffered considerable contamination with Allen. The second, third and fourth wave stocks appear to

represent 26C relatively free from adulteration or contamination although there is some suggestion of a small progressive drop in ginning percentage with each extra season of multiplication. Fifth wave 26C, the produce of one season's multiplication at Daudawa of the New Nucleus Stock issued in 1951, differs little in yield from earlier issues but the same stock grown on at Samaru for a further season has given a distinctly higher lint yield. No reason can be given for this nor for some of the apparent discrepancies between the Samaru and Daudawa figures (e.g., those for second and fourth wave 26C). These latter must be put down to experimental error. It should be noted, moreover, in considering these results as a whole that the seed actually tested (about 3 lb. only of each stock) is an extremely small proportion of the seed stock concerned and that it was not found possible to take full precautions to make each a truly representative sample. The total stock of seed of first wave 26C for instance amounted to over 6,000 tons made up the whole season's produce of a widespread area of the commercial crop. Even in the case of stage B produce the seed planted was little more than 1/3000 of the stock and the need to consider what picking to take it from was overlooked.

DISTRICT VARIETY TESTS

The series of eight district variety tests, one at Samaru and seven at other stations run by the field staff of the department, represent perhaps the most immediately important and interesting part of the season's work. The yields are presented in Table II the actual weight of seed-cotton in lb. per acre being given for the "control" type (Samaru-grown New Nucleus Stock of 26C) and the yields of the other strains expressed as a percentage of this. These strains are shown in the table under treatment numbers only. The "key" to these is—

Treatment No. 6	Samaru 26C Selection	.. .. .	479-25
" " 5	" " " " " "	.. .. .	49160-23
" " 2	" " Select Progeny Bulk	.. .. .	
" " 3	" " Selection	.. .. .	4998-14
" " 4	" " " " " "	.. .. .	49113-18
" " 7	" " " " " "	.. .. .	4717-BSD
" " 8	" " " " " "	.. .. .	4744-BSD

TABLE II.—DISTRICT VARIETY TESTS SEASON, 1952-53
Seed-Cotton Yields from Eight Experiments Grouped

Locality with yield of 26C New Nucleus Stock in lb. per acre	Yields expressed as percentage of 26C New Nucleus Stock (for Key to Strain numbers see text)							S.E. Per cent
	6	5	2	3	4	7	8	
Group I.—Localities within Main Cotton Belt								
Samaru 824	103	103	96	103	103	99	91	2.9
Daudawa 515	114	105	114	109	110	101	103	5.4
Gusau 735	103	106	100	104	102	97	98	3.4
Group Average —	107	105	104	105	105	99	97	—
Group II.—Eastern and North- Eastern Areas								
Gombe 459	110	97	105	104	106	104	107	4.0
Maiduguri 767	109	91	105	115	101	106	106	3.7
Group III.—Northern Fringe of Cotton Belt								
Kano 251	109	116	105	100	106	105	95	5.8
Group IV.—Southern Fringe (Longer rainy season)								
Kontagora 116	121	122	102	88	111	88	85	10.5
Zonkwa 130	104	115	104	96	77	91	90	8.4
Overall Average for Eight Experiments	109	107	104	102	102	99	97	—

Planting Dates were all between the 2nd and the 11th of July except for Maiduguri and Zonkwa. Both these were planted on 15th July.

All represent material derived from 26C stock and of 26C general character but the majority (and in particular treatments 6 and 5) are of distinctly better lint quality. All had shown good yields in Samaru tests in previous seasons. In studying the figures of Table II it should be remembered that the "control" is the New Nucleus Stock whose yield relative to older stocks of 26C is given in Table I above. No commercial bulk 26C or Allen was included in these tests. It may be taken that a selection giving an advance on New Nucleus Stock is substantially heavier yielding than the older stocks.

It is apparent from the results over the whole eight localities that strains 6 and 5 are most promising. There is however evidence of interaction of strain with locality and strain 5 has done relatively poorly at Maiduguri and Gombe while both it and strain 6 failed to show a convincing advance over control at Samaru and Gusau. These are two sites where the overall yields were high and conditions favourable for all strains to give good results. The figures for Kontagora and Zonkwa, where conditions were less favourable, are in marked contrast. It would appear that strains 6 and 5 are more tolerant of poor conditions. This may be connected with their earlier cropping characteristic; both give a bigger proportion of their total yield in the early pickings.

The yields at Samaru, Daudawa and Gusau with the final picking omitted, are given in Table III.

TABLE III.—SEED-COTTON YIELDS DISTRICT V.Ts. OMITTING LATE PICKINGS

<i>Locality</i>			<i>26C</i> <i>lb. per acre</i>	<i>Strain 6</i> <i>as per cent 26C</i>	<i>Strain 5</i> <i>as per cent 26C</i>
Samaru	..	..	662	116	109
Daudawa	..	..	301	120	120
Gusau	..	..	652	106	111

The additional advantage of earliness is well brought out by these figures. Its value in the event of late planting is being tested in the coming season.

The figures given above are all of seed-cotton yields. Ginning percentages for the different strains in different localities varied rather widely and were somewhat inconsistent. On average both Strains 5 and 6 fell below the high standard of New Nucleus Stock, strain 5 by about 1 per cent and strain 6 by about 2.5 per cent. The latter therefore, in terms of lint yield, averaged little more than 1 per cent increase over control but strain 5 remained 3 per cent superior. Both strains are being subjected to intensive reselection to improve this character. As both are at present very definitely above 26C in spinning quality some slight drop in quality can be risked in this process.

A point of interest to be noted in Table II is the high yield at Maiduguri—767 lb. of seed-cotton per acre. This was obtained on a rainfall of only 25 inches and with stand averaging only 65 per cent of holes planted, due to difficult conditions. Although yields of this order are not uncommon on similar rainfall in other territories, the main cotton belt of Northern Nigeria enjoys a much greater rainfall and doubts have been expressed as to the practicability of rain cultivation at Maiduguri. It appears that the 26C type, bred under a rainfall of 40 inches, is sufficiently versatile to do well with much less. It is at the other limit, that of prolonged rainy season (and consequently more pests) that a different type of cotton would appear desirable though neither Kontagora nor Zonkwa always give such poor yields as those recorded for this season's experiments.

STRAINS TEST

Additional Samaru 26C derivatives, brought forward from previous seasons, were included in a balanced lattice experiment with 49 treatments in eight-fold replication. As regards yield differences the results were disappointing. The New Nucleus Stock of Samaru 26C was included as the standard of comparison and gave a yield of 672 lb. of seed-cotton per acre.

It appeared to have been favoured in three of its eight replicates and only three of the reselections under trial gave an advance on this figure. However, taking into account field observations, laboratory data and spinning test results from the previous season, a number of the others were considered worth further trial.

REPLICATED PROGENY ROW TESTS

Progenies of single plant selections were compared in two replicated experiments. One contained forty-nine progenies, all derived from 26C, in eight-fold replication and the other sixty-four progenies with nine replications. This latter included some selections from Allen D5, and 26 G, H and I. Yields were high with significant differences between progenies.

Some thirty-seven in all were considered worth carrying forward six of these being of particular promise combining good yield with apparently satisfactory lint quality.

INHERITANCE OF RESISTANCE TO LEAF TATTERING

A replicated experiment comparing plants raised from seed collected from more and less tattered parent plants, within a 26C sub-strain, gave a significant result. Scored for severity of leaf tattering by three observers independently a small but clearly significant difference was found, the plants from less tattered parents showing less damage on average.

This tattering, ascribed to Mirids of which *Campylomma* is by far the most frequent here, is most erratic in its incidence and plant to plant differences have not yet been related to any characteristic of the plant though differences in susceptibility between strains such as MU 8 and 26C had already been noted.

SPINNING TEST RESULTS

Reports on samples from the 1951-52 experiments, sent to the Shirley Institute for testing, have confirmed previous indications that there is wide variation in spinning quality within Samaru 26C material. In general the better spinning selections have lower ginning percentages but several of high seed-cotton yield have shown a distinct advance on 26C control samples in yarn strength and fineness.

The strain 49160-23 referred to under District Variety Tests (above), which was already known from a previous test to be of promising quality, gave a yarn strength figure (corrected count by strength product at 40s) 18 per cent above that of 26C.

New Nucleus Stock show a small advance on older 26C stocks, as expected, while a representative of 26C/479 derivation (see District Variety Tests) gave higher yarn strength and was of very definitely lower standard hair weight.

SUPPLEMENTARY VARIETY TEST

An interesting comparison of a range of types other than 26C was made in a separate replicated experiment as a distinct and separate part of the work at Samaru.

As the types which it was desired to include covered a wide range of plant habit and vigour 3-row plots were employed and the yields of the central row were recorded separately. This has provided data from which it is hoped to be able to study the effect of competition between diverse strains. This study is not yet completed but it appears that competition has depressed the yields of the outside rows of the two strains of weakest vegetative growth in comparison with yield of central row. This effect is not at all large however and, apart from these two strains (the two sub-types of MU8A) comparisons based on the total yields of all three ridges appears quite sound. It is these yields which are given in Table IV.

TABLE IV.—DATA FROM SUPPLEMENTARY VARIETY TEST

Strain	Seed-Cotton		Gin Per cent	Lint		Earliness see (1)	Lint Length mm
	lb. per acre	Per cent		lb. per acre	Per cent		
26C Nucleus Stock	685	100	35.7	245	100	65	35.5
MU8A Barberton Stock ..	747	109	31.3	234	96	85	31.0
MU8A Treble B.C.P. ..	755	110	32.1	242	99	77	31.9
BAR 17/1 On type bulk ..	632	92	30.9	195	80	66	35.2
BAR 17/1 Off- type bulk ..	654	95	31.6	207	85	69	34.6
BAR D28—B.C.P.	785	115	30.3	238	97	50	34.2
„ „ —4..	818	119	32.5	266	109	54	35.3
„ „ —11..	903	132	31.9	288	118	59	32.8
„ „ —13..	765	112	30.2	231	94	65	34.6
„ „ —14..	849	124	30.4	258	105	46	35.0
„ „ —15..	784	115	32.6	256	105	57	34.6
Sokoto Local ..	691	101	31.8	220	90	63	33.6
Okene Local ..	390	57	32.8	128	52	20	31.8
Ishan ..	544	80	34.5	188	77	10	34.7
BAR 4/16 ..	393	57	32.2	127	52	52	39.8
(G. barbadense) ..	—	—	—	—	—	—	—

(1) Earliness of Cropping, viz. weight of crop produced by 31st December expressed as percentage of total crop. Picking continued into February.

Growth was good and yields high but with very marked differences between some of the types. The experiment was sown on 7th July as a balanced incomplete block design with fifteen strains in seven fold replication (plot area 1/150 acre, spacing 18" on 3 foot ridges).

The yields given by the BAR D28 selections are note-worthy. Type D28 originated in the Northern Gold Coast and under selection at Shambat yielded a progeny homozygous for a high degree of resistance to blackarm. Grown at Samaru in 1949-50 this progeny was found to crop well and to be "splitting" for earliness of cropping and lint length although predominantly late and of poor lint length. The five selections included in this test have all given a distinctly higher seed-cotton yield than the 26C control though only the three highest are significantly better. As with almost all types introduced for trial against 26C however, a considerable part of the advantage in yield is lost when ginning percentage is taken into account. Nevertheless this material remains promising in so far as it is responding to selection for higher ginning percentage and increased lint length and has given selections no later in cropping than 26C.

The difference between the two sub-types of MU8A is of interest. The "Treble BCP" represents the result of selecting and bulking chosen plants and repeating the process over three generations. The result has been a slight improvement in ginning percentage and lint length with negligible change in seed-cotton yield and some loss of earliness. It appears that there is no likelihood of producing a change of worth-while magnitude by this means.

B.—COTTON ENTOMOLOGY

By M. A. Choyce

INTRODUCTION

Routine records on the incidence of pests and the causes of crop loss were continued on standard observation plots at Daudawa, Gusau, Kontagora and Yola. At Gombe similar

records were taken for the first time. At Samaru observations were made on the Botanist's rotation plots as in previous years. These records reveal that Red Bollworm populations were lower than those reported last year, except at Kontagora and Yola. Pink Bollworm attack was notably higher than elsewhere at Yola and Gombe.

Studies on the pupal periods of the Red Bollworm, and on the emergence and diapause of the Pink Bollworm, are being continued. Emergencies from Red Bollworms set during the 1951-52 season were disappointing, and no firm conclusions can be drawn from them. Records of Pink Bollworm pupation and emergence confirm the findings given in the 1950-51 Progress Report.

Numerous samples of seed-cotton and cotton seed from the ginneries in the Northern Region were examined, and these again revealed a predominantly low infestation of Pink Bollworm.

Two insecticide trials were held during the season. At Samaru good control of the mirid *Campylomma* was achieved, together with a marked reduction in leaf tattering. The precise effect on yield was obscured by the wide variation in fertility between the plots in the experimental area. At Daudawa the best insecticide treatment resulted in an increase of 50 per cent in the yield of clean seed-cotton, compared with the control.

INSECT PESTS

(a) *Diparopsis perditor*—The Red Bollworm.—Details of Red Bollworm activity during the season are given in Table I.

TABLE 1.—*DIPAROPSIS PERDITOR*. EGG AND LARVAL POPULATION
1952-53 (FIGURES FOR 1951-52 IN PARENTHESIS)

Station	Eggs per plant	Egg count peak/acre	Larval peak/acre
Samaru (Botanist)	4.8 (13.9)	18,290 (34,920)	1,480 (2,290)
Samaru (Insecticide)*	1.5	3,570	1,970
Daudawa Standard	2.8 (9.3)	5,400 (20,760)	1,620 (3,360)
Daudawa (Insecticide)*	2.2	10,760	2,340
Kontagora Standard	20.3 (10.7)	57,210 (18,350)	5,630 (2,680)
Gusau „	3.5 (4.6)	7,260 (9,190)	2,830 (6,600)
Yola „	6.0 (0.9)	15,240 (6,400)	4,180 (2,720)
Gombe „	4.5	9,750	1,553

*Refers to observations on the control plants of the Samaru Insecticide trial from 7/9/52 to 31/1/53, and Daudawa Insecticide Trial from 26/10/52 to 31/1/53.

At Samaru the attack was less than that recorded last year, both in duration and in numbers of larvae in the crop. Only at Yola and Kontagora was the incidence recorded as being higher than last year. At Kontagora egg laying was particularly heavy and prolonged, and the last larvae was found in the crop at the end of January.

Emergencies of adults from long-term pupae of *Diparopsis* set during the 1951-52 season were too few to draw any definite conclusions. Further settings of larvae were made during the 1952-53 season, and at Samaru, pupae are also being observed under laboratory conditions. Details of emergencies from these will not be available until later this year.

(b) *Platyedra gossypiella*. Pink Bollworm.—Table II shows the peak populations of pink bollworm found in green and split boll samples, together with the number of larvae per 1,000 split bolls taken from all pickings of the crop.

TABLE II.—PINK BOLLWORM POPULATIONS IN GREEN AND RIPE BOLL SAMPLES 1952-53 (FIGURES FOR 1951-52 IN PARENTHESIS)

	Peak population per acre in:—		No. of larvae per 1,000 Split Bolls
	Green Bolls	Split Bolls	
Samaru (Botanist Rotation)	830 (6,060)	300 (1,020)	19.6
Daudawa Standard	810	120	5.4
Kontagora „	1,110 (890)	120	5.3
Gusau „	710 (25,130)	760 (4,260)	24.2
Gusau Peasants	—	—	30.3
Yola Standard	11,680 (Nil)	3,000 (Nil)	118.8
Yola Peasants	—	—	99.9
Gombe Standard	7,990	4,610	168.4

At Yola and Gombe, where the incidence was high compared with other stations, appreciable numbers of larvae were found in the crop from late October until the end of the season.

A sample of the crop of the Cotton Variety Trial at Gombe roller-ginned at Samaru showed ninety-five living larvae per 10 lb. of cotton-seed. In the commercial crop twenty-eight samples from markets in Bauchi and Adamawa Provinces, saw-ginned at Gombe, contained only ten living larvae per 10 lb. of cotton-seed. The difference in these records is probably accounted for by a rather lower general infestation of pink bollworm in peasant grown cotton, and also by the ability of the saw-gins to remove or kill a high proportion of larvae in the seed cotton. The efficiency of the saw-gin compared with the roller gin in this respect has been demonstrated on a small scale with the machines at Samaru.

An examination of samples of cotton-seed and seed cotton from seven ginneries during the period February to August, 1951, confirmed previous reports of a low infestation of pink bollworm in the commercial crop.

DIAPAUSE AND EMERGENCE OF PINK BOLLWORM DURING 1951-52

Pink bollworm collected in the Samaru area towards the end of the 1951-52 season were set singly in tubes under laboratory conditions to determine the dates of pupation and emergence.

Details of the dates of collection and emergence are given in Table III. The results confirm the findings given in the 1950-51 Progress Report, nearly half of the moths emerging during May and June, and over 90 per cent by the end of July.

TABLE III.—EMERGENCE OF PINK BOLLWORM, 1951-52

Date of Collection	No. Set	No. Emged.	MONTH OF EMERGENCE									
			1951 Dec.	1952 Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
December 1 to 15, 1951..	68	38	8	11	1	3	2	5	5	2	1	—
December 16 to 31, 1951 ..	85	50	—	5	1	2	3	16	13	6	4	—
January 1 to 15, 1952 ..	127	92	—	3	3	13	6	24	23	15	4	1
January 16 to 31, 1952 ..	17	6	—	—	—	—	—	4	1	1	—	—
February 1 to 16, 1952..	4	3	—	—	—	2	—	1	—	—	—	—
Totals	301	189	8	19	5	20	11	50	42	24	9	1

(c) Other Bollworms:

Earias spp.—Spiny and Egyptian Bollworms.

Argyroplote leucotreta.—False Codling Moth.

Heliothis armigera.—American Bollworm.

At Samaru the population of *Earias* was small early in the season, though some damage was caused to terminals of the cotton plants. Towards the end of the season numbers increased, reaching 3,400 per acre on the control plots of the Insecticide Trial early in December, and 2,000 per acre on the Rotation Plots in February.

At other stations *Earias* was recorded in small numbers, mainly in the latter part of the season.

Argyroplote was rare at all stations except Gombe, where it was recorded from mid-November to January with a peak population of 1,400 per acre.

Heliothis was either absent or rarely reported from any station during the season.

(d) *Dysdercus supersticiosus*.—The Cotton Stainer. The pattern of the stainer attack was similar to that recorded in previous years, the insects entering the crop in September, breeding, and leaving the crop at harvest.

At Samaru and Daudawa few stainers were recorded on the observation plots, but larger numbers were present on better grown cotton at both these stations. At Daudawa, on Stage B cotton, 4,200 adults per acre were recorded early in December, and nymphs were very common when picking was in progress.

At Kontagora and Gusau stainers were more numerous than last year, with peak populations of 6,250 and 4,500 per acre respectively. Up to 3,900 per acre were recorded at Gombe and Yola.

(e) *Mirids and Leaf Tattering*.—The predominant Mirid in the crop at Samaru was again *Campylomma*. Though small numbers were present at the beginning of the season, extensive immigration into cotton did not occur until the middle of September, and the peak population was recorded early in October. Details of the population build-up are given in the results of the Samaru Insecticide Trial.

Lygus was present in small numbers; on the insecticide trial less than one was swept per 100 plants. Other mirids in the crop included *Psallus* sp., and *Deraeocoris* sp., which is predatory.

Leaf tattering, coincident with the general *Campylomma* population, was common at Daudawa and Samaru, but variable in its extent. Some fields at Samaru were heavily damaged, occasional plants being rendered completely sterile, but on the whole, damage appeared to be rather less than that recorded last year.

An eye estimation of the extent of tattering on the "Soil fertility, Spacing, and Planting-date for Cotton" experiment made on 7th and 8th October, 1952, confirmed previous observations. Highly significant differences were recorded between treatments, there being less tattering with wider spacing, later sowing and lower level of fertility. The reduction in damage was, however, too small to nullify the advantage in growth and fruiting obtained by early sowing and high fertility.

(f) *Miscellaneous Pests*.—(Mainly Samaru area) :

- (i) *Brachytrypes membranaceus* (Giant cricket) caused slight damage to young seedlings.
- (ii) *Sylepta derogata* (Leaf Roller) was locally common early in the season and was controlled by hand picking where necessary.
- (iii) *Agonocelis versicolor* ("Andat" or Cluster Bug) and *Calidea* sp. were recorded in small numbers.
- (iv) *Oxycarenus* sp. (Cotton seed bug) was very common in split bolls, breeding extensively but apparently causing little damage.
- (v) *Bemisia* sp. (White fly) was common in December, but no symptoms of Leaf Curl disease were found.
- (vi) *Hemitarsonimus latus* caused typical early symptoms of 'Acariose' on one small area of poorly grown cotton.
- (vii) The gregarious nymphs of a bush locust (*Phymateus* sp.) were numerous on hedges of *Thevetia* sp. during October and November. To prevent damage to cotton experiments many clusters of nymphs were dusted with an insecticide containing 5 per cent D.D.T., 3 per cent B.H.C. and 40 per cent sulphur, and a high mortality resulted. Solitary adults appeared in December, and pairing became common early in May.

- (viii) Examination during May of cotton plants left to standover from the 1952-53 season revealed that about one quarter of the plants harboured larvae of *Sphenoptera* sp., the Cotton Stem Borer. Sampling indicated a larval population of 4,500 per acre together with some pupae and recently emerged adults still in the cotton stems. This pest appears to be of minor importance during the growing season.

CROP LOSS

(a) *Shedding*.—At Samaru maximum shedding of buds and bolls occurred during the last two weeks of October, reaching a peak of 8,700 bolls shed per week per acre on the Rotation Plots. At Yola shedding was heavy throughout October, with a peak of over 19,000 bolls per week per acre. Elsewhere maximum shedding occurred during November or early December.

Table IV summarises the results of an examination of shed buds and bolls, and split bolls at each station.

TABLE IV.—PERCENTAGE DAMAGE BY BOLLWORMS AMONGST SHED BUDS, SHED AND ABORTED BOLLS, AND RIPE BOLLS, 1952-53 (FIGURES FOR 1951-52 IN PARENTHESIS)

Station	Shed Buds	Shed and Aborted Bolls	Ripe Bolls
Samaru (Rotation)	30.2 (62.7)	32.2 (36.7)	25.3 (44.5)
Samaru (Insecticide Control)	50.4	34.9	35.7
Daudawa Standard	30.8 (47.0)	15.9 (29.7)	20.9 (26.6)
Daudawa (Insecticide Control)	44.9	20.7	38.3
Kontagora Standard	59.2 (63.3)	63.9 (59.9)	92.3 (75.2)
Gusau Standard	46.3 (42.2)	31.5 (41.4)	38.3 (65.5)
Yola Standard	52.2 (26.8)	30.3 (24.7)	70.9 (32.9)
Gombe Standard	39.1	29.6	47.9

(b) *Damage to Ripe Bolls*.—The analysis of the damage to non-shedding bolls is given in Table V. The low proportion of clean locks recorded at Yola and Kontagora was partially due to the increased Red Bollworm population at these stations. The percentage of clean locks at Samaru, Gusau and Daudawa was higher than last year.

TABLE V.—PERCENTAGE LOCK DAMAGE IN NON-SHEDDING BOLLS (1951-52 FIGURES IN PARENTHESIS)

Station	Clean	Bollworm Partial loss	Bollworm Total loss	Non- bollworm Partial loss	Non- bollworm Total loss
Samaru (Botanist Rotation)	75.8 (54.6)	5.1	4.4	11.7	2.9
Samaru (Insecticide Control)	68.4	8.2	8.7	11.7	2.9
Daudawa Standard	77.6 (58.7)	2.7	4.8	12.0	2.9
Daudawa (Insecticide Control)	60.3	6.0	11.1	17.2	5.3
Kontagora Standard	18.1 (25.9)	34.1	15.9	11.7	20.2
Gusau	61.2 (47.3)	9.0	10.6	11.7	7.4
Gusau (Peasants)	63.0	10.1	8.0	7.1	11.8
Gombe Standard	57.9	12.8	5.7	16.8	6.8
Yola	28.0 (31.9)	14.8	19.8	27.8	9.6

INSECTICIDE TRIALS

(a) *Daudawa*.—The results of insecticide trials at Samaru and Daudawa since 1949 suggest that a high concentration of D.D.T. is desirable for the control of Red Bollworm. The trial at Daudawa this year was therefore designed to compare the effects of dust containing D.D.T. at a higher concentration and dosage than that used hitherto, with the same dosage of D.D.T. applied as an emulsion.

The treatments, which also included one based on Toxaphene emulsion, were as follows:—

A: Dust containing 10 per cent D.D.T. and 3 per cent B.H.C. applied at rate of 40 lb. per acre, i.e., 4 lb. D.D.T. per acre.

B: 1 per cent D.D.T. emulsion applied at rate of 40 gallons per acre, i.e., 4 lb. D.D.T. per acre.

C: 1 per cent Toxaphene emulsion at rate of 40 gallons per acre, i.e., 4 lb. of Toxaphene (technical product) per acre.

D: Control.

Each treatment was applied three times, the dates of application being 24th October, 14th November and 5th December, 1952. There were eight replications of each treatment on plots of 1/40 acre. The sowing date of the cotton, which was in the experimental area, was 10th July, and five fortnightly pickings were made between 9th December, 1952 and 3rd February, 1953.

A summary of the results is given in Table VI.

TABLE VI.—DAUDAWA INSECTICIDE TRIAL—1952-53

SUMMARY OF RESULTS

(ALL YIELDS IN LB. SEED-COTTON PER ACRE)

	TREATMENTS				S.E.
	A	B	C	D	
1. Bulk Yield, based on 9x12 yards per plot ..	338	348	347	290	11
Percentage: Control=100%	116	120	120	100	—
2. <i>Ripe Crop Sample</i> , based on 1x12 yards/plot. Yield of unsorted seed-cotton (Clean, stained and rotten)	503	536	476	395	16
Percentage: Control=100%	127	136	120	100	—
Yield of clean seed-cotton	449	471	388	307	14
Percentage: Control=100%	146	153	126	100	—
„ clean of unsorted seed-cotton ..	89	88	82	78	—
3. No. of Split bolls produced per plant	3.40	3.83	3.69	3.08	—
Percentage damage by B.W. amongst split bolls ..	20.7	22.3	31.8	38.3	—
*4. Percentage Lock damage in non-shedding bolls :					
Clean locks	78.3	79.8	69.2	60.3	—
Bollworm Partial loss	2.9	3.3	5.6	6.0	—
Bollworm Total loss	4.3	6.6	8.8	11.1	—
Non-bollworm Partial loss	10.7	9.1	13.1	17.2	—
Non-bollworm Total loss	3.8	1.3	3.3	5.3	—
5. Percentage of Shed buds damaged by bollworm ..	—	26.6	—	44.9	—
Percentage of Shed bolls damaged by bollworms ..	—	10.4	—	20.7	—
*6. No. of Diparopsis eggs per plant, 28/10-30/1 ..	—	1.5	—	2.2	—
Diparopsis Index	28	44	81	119	—
Transformed $\sqrt{x+\frac{1}{2}}$	14.9	18.4	25.7	30.7	1.9
Earias Index	39	44	30	51	—
Transformed $\sqrt{x+\frac{1}{2}}$	17.2	19.0	16.0	20.7	1.6

*The methods used for determining lock damage and bollworm indices are given in Emp. Cott Grow, Corp Rps Expt, Stns N. Nigeria, 1951-52.

Yields.—The bulk yields were determined from nine rows of twelve yards in each plot and are lower than the true yields because of handling effects, crop sampling, and interaction at the edges of the plots. Nevertheless, all treatments gave highly significant increases in yield compared with the control.

A more detailed picture of treatment differences is shown by the Ripe Crop Samples, taken from one row of twelve yards in each plot. This row was disturbed as little as possible during the growing season. Compared with the control, all the insecticide treatments gave highly significant increases in yield, both of clean seed cotton, and of unsorted seed cotton which had not been picked over to remove stained and rotten lint.

There was no significant difference in yield between the dust and D.D.T. emulsion, but the latter was more effective than the Toxaphene emulsion. The highest yield, equivalent to 53 per cent more clean seed cotton than the control, followed the use of D.D.T. emulsion.

The increase in yield of clean seed cotton was due to (a) more bolls per plant reaching maturity, and (b) a higher percentage of clean cotton produced by these bolls. With Treatment B, for example, the higher crop production gave an increase of 36 per cent in the yield of unsorted seed cotton, and this contained 13 per cent more clean seed cotton than the control. A combination of these factors resulted in a 53 per cent increase in yield of clean seed cotton.

Bollworm Control :

The dates of application were chosen with a view to controlling the Red Bollworm, and the degree of control achieved, which is reflected in the yield figures, can be gauged from the *Diparopsis* Index for each treatment.

The best treatment was the D.D.T./B.H.C. dust which gave a reduction of 76 per cent in the index compared with the control, but did not differ significantly from the D.D.T. emulsion. A smaller degree of control followed the use of Toxaphene emulsion which gave a 32 per cent reduction in the index.

The *Earias* Index shows no significant difference between treatments. *Earias* larvae were present in the crop until harvest, and many were therefore unaffected by the treatments, the last of which was applied early in December.

(b) *Samaru.*—The yields obtained in previous insecticide trials are to some extent confirmed by the figures for bollworm populations and bollworm damage, but there are some discrepancies which are difficult to explain. It is possible that the increased yields obtained by using insecticides are not exclusively due to the control of bollworm, but that some other pests, for example, Mirids, are also being controlled.

The experiment at Samaru was arranged to distinguish between the effects of mirid and bollworm damage by early sprayings against the former during September and early October, and late spraying against the latter during late October and November.

The four treatments, replicated four times using plots of nearly 1/13 acre, were as follows:—

- A: Early spraying of 0.5 per cent D.D.T. emulsion at 40 gallons per acre. (2 lb. D.D.T. per acre), applied on 8th September, 22nd September and 6th October.
- B: Late spraying of 1 per cent D.D.T. emulsion at 40 gallons per acre (4 lb. D.D.T. per acre) applied on 27th October, 10th November and 24th November.
- C: Early and late spraying, as given in treatments A and B.

D: Control.

The date of sowing was 5th July and picking began on 8th December.

Results :

The predominant mirid present was *Campylomma* ; very few *Lygus* were swept before 16th September and none after this date. The *Campylomma* population was estimated weekly by sweeping a 12 yard ridge in each plot three times, the total number caught being used to calculate the population swept per acre.

Table VII gives the swept population of *Campylomma* per acre per week for each treatment. Numbers were low on the control plots early in September, but migration increased the population to 20,000 per acre by 7th October. After this date there was a rapid fall in the population, so that only small numbers were present after the middle of November.

TABLE VII.—SAMARU INSECTICIDE TRIAL, 1952-53
CAMPYLOMMA POPULATION PER ACRE PER WEEK FOR EACH TREATMENT

Date	A	B	C	D
8th September	1st Early Spray	—	1st Early Spray	—
10th September	0	200	0	100
16th September	910	2,620	810	1,010
22nd September	2nd Early Spray	—	2nd Early Spray	—
23rd September	100	2,720	0	3,530
30th September	1,110	8,170	2,020	7,560
6th October	3rd Early Spray	—	3rd Early Spray	—
7th October	710	12,600	810	20,470
14th October	1,510	2,720	610	5,040
21st October	810	4,340	710	2,120
27th October	—	1st Late Spray	1st Late Spray	—
28th October	200	100	100	1,210
4th November	0	0	0	1,110
10th November	—	2nd Late Spray	2nd Late Spray	—
11th November	400	0	0	1,310
18th November	710	0	0	400
24th November	—	3rd Late Spray	3rd Late Spray	—
25th November	1,010	0	100	100

The degree of control achieved is demonstrated by Fig. 1 at the inside page of back cover which is based on a combination of the results of treatments A and C, which received early spraying, and B and D which received late spraying. Sweeps taken the day after spraying revealed that the population was reduced to less than 5 per cent of that on the unsprayed plots. During the two-week intervals between sprayings the population increased again at a rate similar to that on the untreated plots.

An estimate of the degree of leaf tattering for each treatment was made by eye on 31st October, on three rows of twenty-four yards in each plot, each plant being assessed on following scale :—

- 0—Tattering nil or slight.
- 1—Tattering moderate.
- 2—Tattering heavy.

The scores for each row were transformed by $\sqrt{x+\frac{1}{2}}$ and the mean values for the plots in treatments A and C combined were 4.45, compared with 8.85 for treatment B and D, with a standard error of 0.55. Control of *Campylomma* had therefore been followed by an appreciable decrease in visible tattering damage to the cotton plants.

The flowering records suggest that one result of the early sprays was an earlier peak of flowering in Treatments A and C, presumably because fewer buds were lost due to Mirid feeding.

However, the results obtained from observations on fruiting behaviour and yields are inconclusive owing to the wide variation in fertility within the area of the experiment. For example, in Treatment A, the worst plot yielded 103 lb. of seed cotton per acre, and the best 501 lb. per acre.

The final yields based on three rows of twenty-four yards per plot, are given in Table VIII.

TABLE VIII.—SAMARU INSECTICIDE TRIAL, 1952-53 YIELDS PER

				TREATMENT IN LB. SEED COTTON PER ACRE			
<i>Treatment</i>				<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Yield	..	..	..	323	442	323	318
S.E.	..	..	49.	Differences not significant.			

A contributory factor was the inadequate control of bollworms exercised by the late sprays. Until the experiment can be repeated under more suitable conditions it will be difficult to determine the precise effects of Mirids and bollworms on crop loss.

VI.—PASTURE SECTION

By A. Blair Rains

Although a certain amount of pasture and grassland work has been done in the past by different Officers, it is only during the present year that a Pasture Section has been established.

The first task was for the staff in the section to familiarise themselves with the commoner grasses and legumes, particularly those which appeared to be of value as pasture or fodder crops and as far as possible to be able to recognise them at all times of the year and at all stages of growth.

Another necessary initial step has been to examine the records of earlier pasture work as far as possible to correlate these results. Unfortunately much of this work has suffered from a lack of direction and co-ordination.

The existing collections of forage crops at Samaru and Shika will be considerably enlarged through seed obtained from Kenya, Australia, Southern Rhodesia and the United States. In many cases this seed will enable us to compare the behaviour of several different strains of the same species and there will also be new introductions.

The work is being developed along two fairly distinct lines, that dealing with the problems of the mixed farmers, generally thought of in terms of a "ley", and on the other hand an extensive approach to bush management and the improvement of natural grassland. In each case the first essential is the ability to control grazing—both in frequency and intensity.

Experiments will be started to determine the behaviour, productivity and feeding value of a number of grasses, and also observation studies on plant succession resulting from different treatments.

At present a serious handicap is the shortage of seed of the grasses which we would like to see in more extensive trials and in large-scale plots.

Although palatability and digestibility are factors which are difficult to evaluate and which cannot altogether be obtained from the chemist's analyses, they are being kept to the fore in assessing the value of grasses. Methods of conservation are being considered and the possibility of the foggage method particularly with certain species is being examined. Next season it is hoped to investigate the effects of fertilisers both in terms of yield and in terms of quality.

Work at outstations has been restricted due to lack of seed and to other difficulties.

APPENDIX I

NOMINAL ROLL OF ESTABLISHED STAFF 1-4-52 to 31-3-53

(1) ADMINISTRATION AND STATION MANAGEMENT

Senior Service

W. E. Freeman, B.Sc., A.R.C.S., A.I.C.T.A.	..	..	..	..	..	Senior Botanist, Acting Principal Agricultural Officer, 1-4-52 to 22-2-53.
J. H. Gisborne, B.A., A.I.C.T.A.	..	..	..	..	..	Botanist, Acting Principal Agricultural Officer, 23-2-52 to 31-3-53.
V. F. Olivier	..	..	..	..	..	Senior Agricultural Officer, Station Manager (left on retirement 31-8-52).
D. J. Iddon	..	..	..	..	..	Agricultural Development Officer, Station Manager, 29-8-52 to 31-3-53.
H. N. Booy	..	..	..	..	..	Agricultural Development Officer, Assistant Station Manager.

Junior Service Clerical

M. O. Pearce, First-class Clerk	..	..	..	..	..	Arrived 9-6-52.
D. O. Onwudachi, Second-class Clerk	..	..	..	..	..	—
D. O. Osuoji, Second-class Clerk	..	..	..	..	..	Arrived 17-2-53.
P. O. Ochei, Third-class Clerk	..	..	..	..	..	—
J. A. Adeyeye, Third-class Clerk	..	..	..	..	..	Transferred 20-11-52.
E. C. Ijoma, Third-class Clerk	..	..	..	..	..	—
J. A. Egbeka, Third-class Clerk	..	..	..	..	..	Arrived 2-9-52.
E. Alabraba, Third-class Clerk	..	..	..	..	..	Arrived 2-9-52.
E. A. Ogoro, Clerical Assistant	..	..	..	..	..	—
P. H. Ajakaiye, Clerical Assistant	..	..	..	..	..	Transferred 17-3-53.
J. C. Obiajulu, Clerical Assistant	..	..	..	..	..	Converted from F.O. 1-1-53.

Junior Service Technical

I. Kiru, Senior Agricultural Assistant	..	..	..	..	..	Transferred 10-2-52.
H. I. Chidebe, F.O. II	..	..	..	..	..	—
S. J. Aleriwa, F.O. II	..	..	..	..	..	—
T. E. Oyibo, Laboratory Attendant	..	..	..	..	..	Appointed 1-6-52

Junior Service Artisans, etc.

J. E. Obi, Mason	..	..	..	..	..	—
E. O. Ifeacho, Carpenter	..	..	..	..	..	Transferred 22-9-52.
L. A. Oshunbayo, Blacksmith	..	..	..	..	..	Transferred 22-9-52.
J. A. Ukwu, Motor Driver	..	..	..	..	..	—
Musa Garkida, Motor Driver	..	..	..	..	..	—
S. Ekundayo, Motor Driver	..	..	..	..	..	Appointed 10-7-52.

Junior Service—Messengers, etc.

Okon Umoh, Telephone Attendant	..	..	..	..	..	—
C. O. Chife, Messenger	..	..	..	..	..	—
Halilu Zaria,	..	..	..	..	..	—
D. D. Dzer,	..	..	..	..	..	—
E. B. Etim,	..	..	..	..	..	—
D. O. Inyamah,	..	..	..	..	..	—
J. E. Obani,	..	..	..	..	..	Appointed 22-7-52.

(2) AGRONOMY SECTION

Senior Service

E. J. Butler, B.A. (T.C.D.),	..	..	..	..	..	Senior Agricultural Officer, Agronomist 15-1-53 to 31-3-53.
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Junior Service Technical—Cotton Breeding

T. O. Agulana, Agricultural Assistant, Grade II	..	..	---
G. O. Ogunbayo " " " III	..	Transferred 31-7-52.	---
S. O. Abodunde " " " III	..	Arrived 2-9-52.	---
I. S. Lado, Field Overseer, Grade II	..	..	---
K. A. Ushie " " " II	..	..	---
I. M. Anyanwu, " " " II	..	Resigned 2-11-52.	---
D. O. Iheonu, Laboratory Attendant	..	..	---

Junior Service Technical—Entomology

L. Akanle, Agricultural Assistant, Grade III	..	..	---
F. A. Bepeh, Field Overseer, Grade II	..	..	---

(6) PASTURE RESEARCH SECTION

Senior Service

A. B. Rains, B.Sc. (Wales), Dip. Ag. Sc. (Cantab.)	..	Pasture Research Officer, 29-9-52 to 31-5-53.	---
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Junior Service Technical

J. A. Turton, Field Overseer, Grade III	..	..	---
Yakubu Dirisu, Laboratory Attendant	..	..	---

APPENDIX II
MEAN MONTHLY RAINFALL AT NORTHERN REGION AGRICULTURAL STATIONS (INCHES)

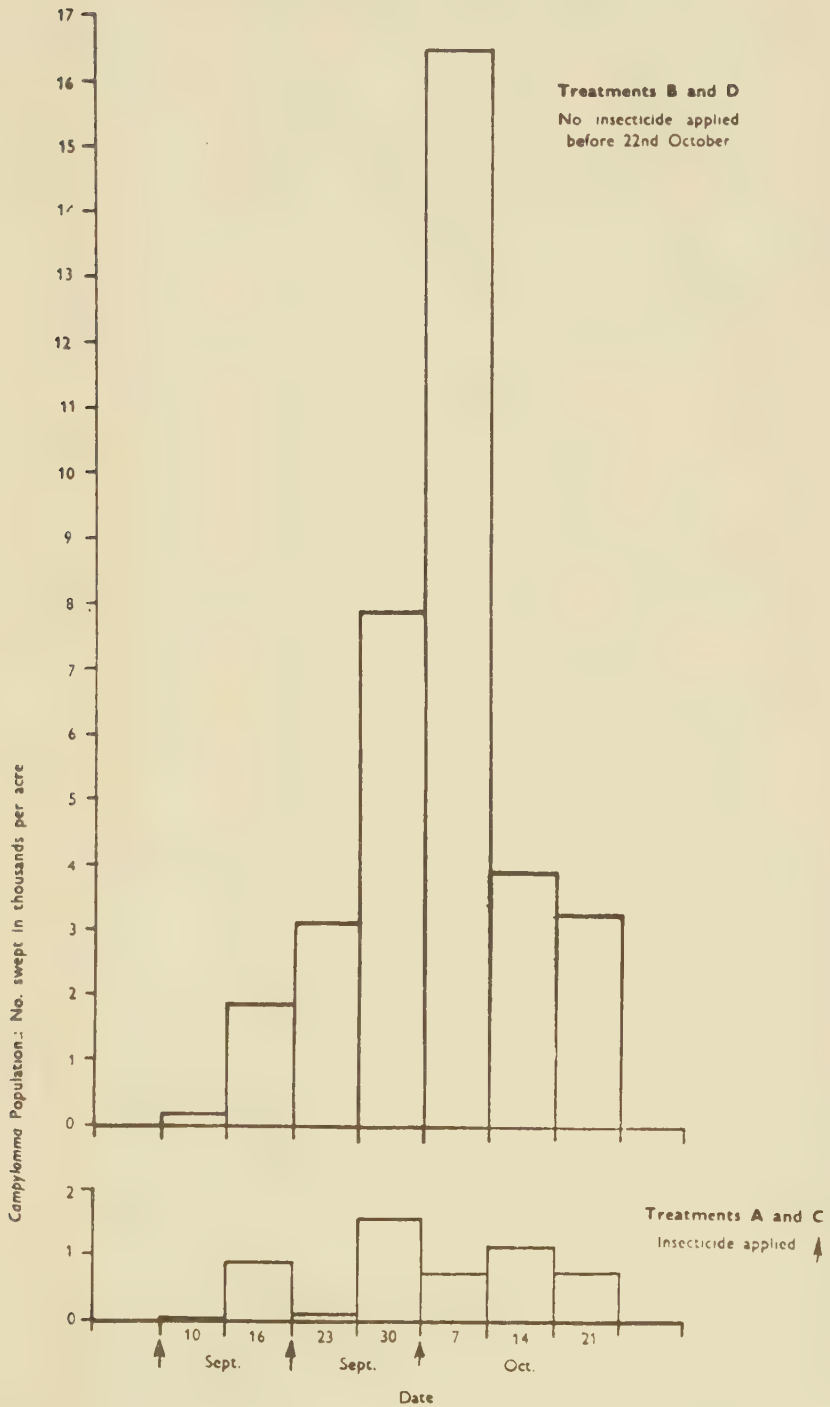
Station	(Latitude 'N)	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Bauchi ..	(10½)	—	—	0.06	1.38	3.78	6.09	9.15	14.39	6.82	1.62	0.09	0.01	43.39
Bida ..	(9)	—	0.27	1.34	2.41	6.08	7.07	7.86	8.68	9.52	4.07	0.38	0.01	47.69
Daudawa ..	(11½)	—	0.01	0.24	1.29	5.05	6.56	8.69	13.34	8.59	1.37	0.05	0.02	45.21
Daura ..	(13)	—	—	—	0.11	1.56	2.73	6.31	10.10	3.91	0.36	—	—	25.08
Gusau ..	(12½)	—	0.03	0.77	0.84	3.31	4.62	7.40	12.55	6.76	1.01	—	—	37.29
Ilorin ..	(8½)	0.25	0.66	2.14	4.11	6.65	7.58	5.45	4.98	9.52	8.65	1.20	0.26	49.65
Kafinsoli ..	(12½)	—	—	—	0.24	2.46	3.97	7.71	10.95	5.73	0.48	—	—	31.54
Kano ..	(12)	—	0.02	0.08	0.44	2.38	4.11	8.10	11.92	5.48	0.60	—	—	33.13
Kontagora ..	(10½)	0.03	—	0.76	1.80	4.48	5.77	7.67	10.84	11.09	3.96	0.14	—	46.54
Maiduguri ..	(11¾)	0.02	—	—	0.25	1.58	2.70	6.85	8.76	4.20	0.75	0.01	—	25.13
Maigana ..	(11)	0.01	0.03	0.32	1.32	4.89	5.54	8.22	13.63	8.03	1.36	0.05	—	43.40
Okene ..	(7½)	0.33	0.62	2.28	4.69	6.45	6.77	6.61	5.23	8.79	6.41	0.75	—	48.93
Riyom ..	(9¾)	—	0.35	0.96	3.62	6.69	8.00	9.22	12.21	9.55	2.90	0.09	0.13	53.72
Samaru ..	(11¼)	—	0.04	0.32	1.26	4.94	6.42	8.68	11.92	8.62	1.43	0.03	0.01	43.67
Sokoto ..	(13)	—	—	0.03	0.48	1.75	3.09	6.55	10.77	5.15	0.49	—	—	28.31
Yandev ..	(7½)	0.31	0.69	1.34	3.97	7.16	7.77	5.21	6.66	10.87	8.37	0.58	0.18	53.11
Yola (Kofare)	(9¼)	—	—	0.21	1.29	5.01	6.01	6.06	4.64	8.36	1.35	0.14	—	33.07
Zonkwa ..	(9¾)	0.01	0.02	1.12	3.69	7.26	9.30	9.19	12.80	10.62	4.45	0.25	0.19	58.90

APPENDIX III

NAMES OF PLANTS IN COMMON USE IN NORTHERN NIGERIA

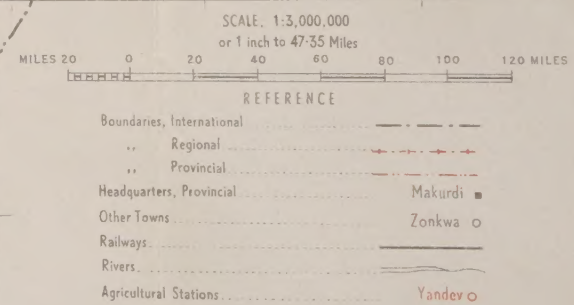
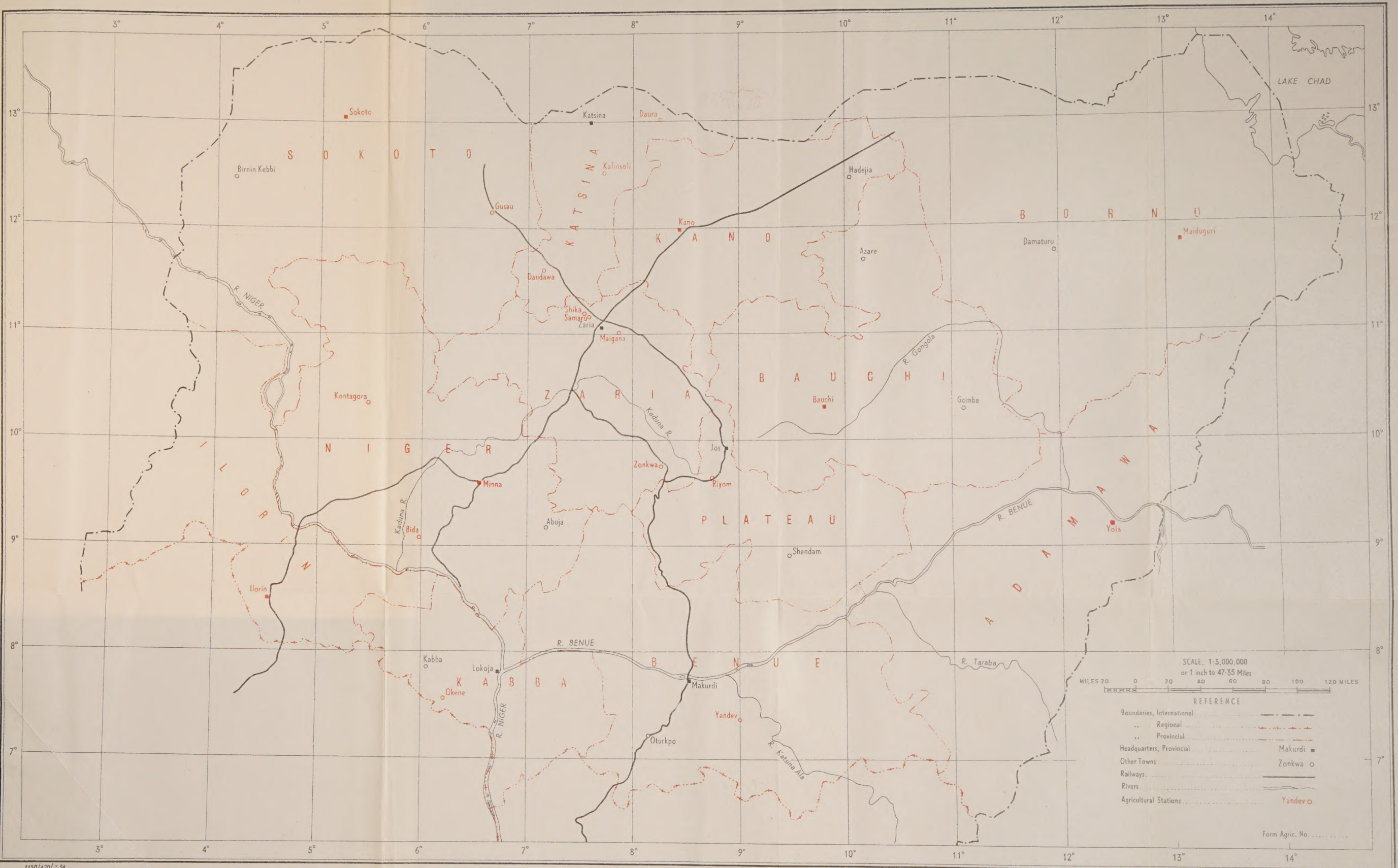
Acha	Digitaria exilis (staple grain crop of some hill tribes, particularly on Bauchi Plateau).
Benniseed	Sesame—sesamum indicum.
Cocoyam	Colocasia esculentum, Xanthosoma sagittifolium.
Dauro	Pennisetum spicatum, transplanted from nursery beds about July-August.
Gamba	Andropogon Gayanus (and occasionally A. tectorum) a large grass, used in planted fallows and found wild as climax species in much of the Region.
Gero	Pennisetum typhoideum, early planted, harvested at four to four and a half months.
Guineacorn	Species of grain sorghums.
Kyasuwa	Pennisetum pedicellatum and other small Pennisetums.
Maiwa	Pennisetum spicatum: varieties differ from Dauro in being longer season (six months) and never transplanted.
Millet	Normally means Gero (P. typhoideum).
Neem	Melia azedarach.
Rama	Hibiscus cannabinus.
Rizga	Coleus dazo.
Tamba	Eleusine corocana, finger millet.
Tumuku	Coleus dysentericus.

SAMARU INSECTICIDE TRIAL—1952-53 **Fig. 1**



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